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The Practical Farm Library

MAKING CORN PAY

By S. M. JORDAN

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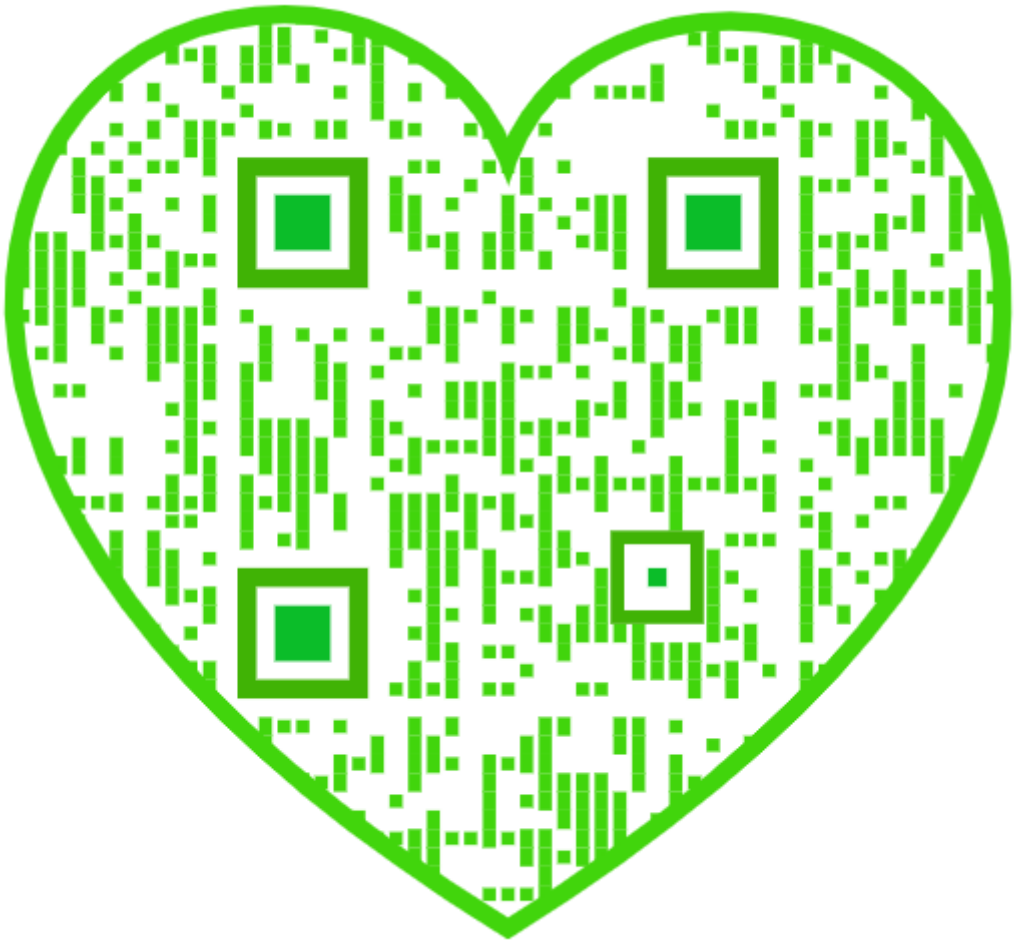
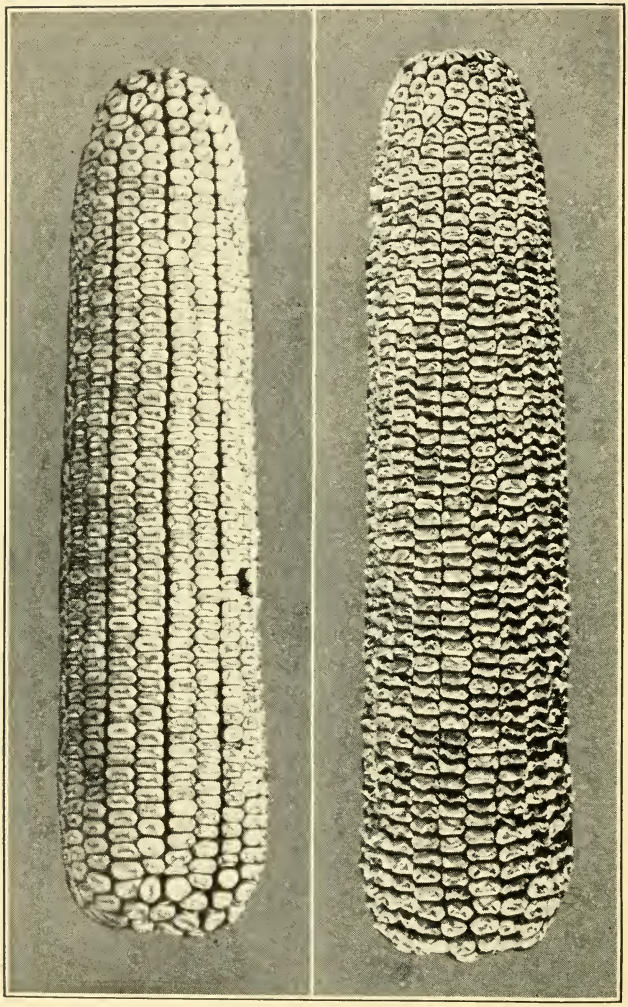




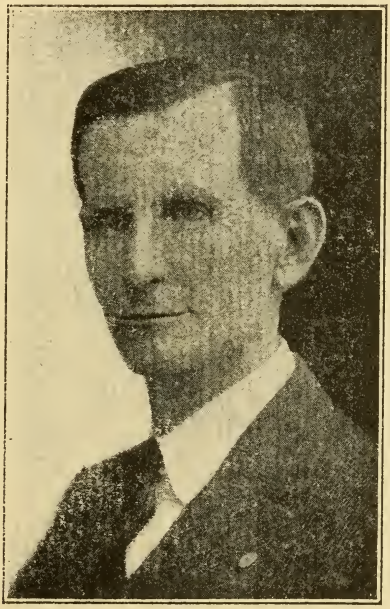
NEARLY PERFECT EXHIBITION EARS

Single Champion Ear, Reid's Yellow Dent | A good ear, but rather too rough.

Making Corn Pay

By S. M. JORDAN

Manager of the Pettis County (Missouri) Bureau of Agriculture



S. M. JORDAN

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A Corn Talk

The need for another book on the subject of corn growing might not seem apparent, as there is perhaps nothing very new that can be said—yet, since so many are not putting into practice such things as will make for better yields, to tell the story again in perhaps somewhat different style, may be useful at this time.

It will be the object to put the entire matter in as plain and clear form as it can be done, that everything may be easily understood by a beginner as well as by those who are older.

The study of corn is no exception to the rule that the more we know about any question the more fascinating the study becomes. If the writing of this book will aid some youngster in getting better results for his labor, thereby enabling him to make his farm more remunerative, that he may pay off the mortgage and build a good home; that himself and his family may be well provided with the comforts of life—then the efforts of the writer will be well repaid.

"A bumper crop of corn cannot be grown from scrub seed in scrub soil with scrub care." The above principle if thoroughly incorporated into one's corn ideas will certainly do him good, and the more thoroughly it becomes a part of him the more completely will he heed the facts, since no one thing will produce a good crop of corn. While perhaps rainfall is the greatest one factor in corn production, there are a great many things that will aid materially in conserving and rightly handling rainfall or soil moisture.

CHAPTER I

Production of Seed

There are only a few farmers in the best corn sections that have not progressed beyond the practice of getting their seed from the corn crib just a little while before planting time. Every man who thinks should know that there is as much difference in the power of two different grains of corn to produce under the same conditions, or in different varieties of corn to produce under adverse conditions, as we find in the different individuals in live stock. In the production of seed corn, as in the production of high quality animals, three fundamentals must be considered. We have produced the splendid live stock that we have by *selection, breeding, and feeding.* To make the same degree of improvement in seeds these three principles must be adhered to, and in the same proportion.

The matter of breeding seed in this country is comparatively new. We have resorted to selection and feeding, but omitted the factor of breeding.

SEED SELECTION

It is impossible to determine the producing qualities of an ear of corn to a very great degree by examination. If we are able to form even an opinion about the producing qualities of an ear of corn, we should at least know something of the qualities of the plant that produced the ear. Since nothing but an examination of the stalk and its organs can give us this information, we must study the plant.

It then follows that in the field is the only place that gives such an opportunity, hence we assume that selecting the seed from the field is the one best way.

The plan that seems most satisfactory is to go into the field as soon as the first ears ripen. This is indicated by the husks turning brown. It will be found that some ears ripen much earlier than others, and it will also usually be the case that these early ripening ears are good ones. It is commonly noted as well that they are either medium in height on the stalk, or low, which is desirable. If these early maturing ears only are selected, and the same plan kept up for a few years, it is evident that if care is exercised in not reducing the size of the ear the time of maturity can be shortened somewhat without decreasing the yield. If this can be done it is in most cases desirable.

FIG. 1—ROOT SYSTEMS

A great root system on stalk at left. Note also the short joints. The one at the right has poor root system, and joints are too long.

In starting between two rows to select seed corn, about the first thing that should be noted on a pro-

spective plant is the brace root system. By brace roots we mean those which come out from one or two and sometimes three joints above the ground, reaching down to the ground, Fig. 1. They are apparently chiefly braces, as the name indicates, but the root system that is below the ground, under ordinary conditions, is largely indicated by the brace root system. If one will make a trial of determining the difference in the root system of different plants, he can do so by pulling up single stalks that have no brace roots and compare the ease with which they are removed with other single plants that have good brace roots. It will be found that in nearly all cases the plant with the good brace root system will be much more difficult to pull up. The principle that a plant cannot be better than its root system makes it should be kept in mind during the whole process of growing corn. We will need to think about this same thing seriously in the chapter on cultivation.

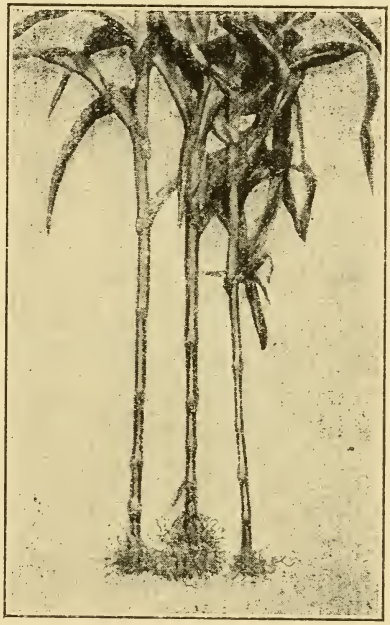


FIG. 2—THREE PLANTS FROM THE SAME HILL

Note the difference in size, length of joint and extent of root systems.

If the root system is about what is desired, the

next thing to be noted is the length of the joints, Fig. 2. If all other things are equal, I much prefer a seed ear from a short-jointed stalk than from a long-jointed one.

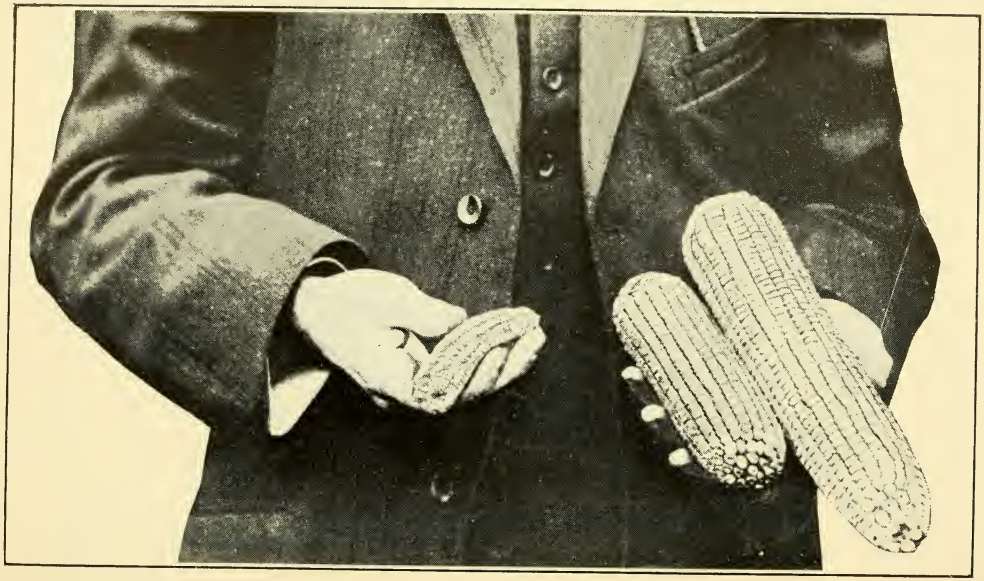
FIG. 3—VARIATIONS OF PLANTS

Three growing stalks from the same hill, all the grains planted alike at the same time; two are failures, yet had equal chances with the good one at the start.

Leaves, in a sense, are factories that manufacture plant food into plant tissue. Since there is a leaf for every joint or node on the corn plant, it would appear that, to a certain degree at least, the greater number of nodes on the corn plant in a given height, the better would be the corn factory. It is also well to observe that the leaves are long and broad. By comparison a great difference will be found in these features, Fig. 3. I prefer the ear to be in height from three to four feet from the ground. The height of the ear on the stalk is not vital so far as yield is concerned, but the lower ear makes gathering more convenient, and the stalk is less likely to fall.

THREE PLANTS FROM ADJOINING HILLS

Three grains were planted at the same time in the same way at uniform depth side by side and cared for in the same way. One succeeded, while two failed. There is a cause for it.



THREE EARS FROM THE SAME HILL
The wonderful variation of plants is shown in this exhibit.

The ear should point downward when ripe, with a medium length shank, Fig. 4. It should point downward for the reason that when the husks begin to ripen they will frequently open somewhat and allow the rain to run into the ear. If it is pointing downward, it also indicates that the shank is not too large and strong. An ideal stalk should not be too long above where the ear is formed.

Ideal conditions are here described. It will be found that comparatively few stalks come near to this ideal, yet the more nearly we can approach them the better results we will have in getting ears that produce well. This, however, is only from the mother side of the ear.

FIG. 4—TWO TYPES OF EARS

Note one ear pointing downward, as it should when ripe, and the other pointing upward, which is wrong, when ripe.

If we should find a stalk and ear as nearly approaching the perfect as could be found, and close around it were some poorly formed plants with inferior quality in all their organs, many of the grains on the ear of the ideal plant would be sired from the bad plants surrounding it, and this condition would interfere materially with the quality of the ear if used for seed. This matter will be discussed a little further in the chapter about the breeding patch.

In a good field of corn a man should be able to gather perhaps from 300 to 500 ears from the very best plants in one day. Ten ears of the size we commonly like for a seed ear will plant approximately one acre. If one can secure 500 ears in one day, he should have enough seed to plant 50 acres. From comparisons made between what is called crib seed and stored seed—by stored seed meaning seed saved at gathering time and stored away—a difference has been shown of between three and five bushels an acre in favor of stored seed. Seed of that character will not, however, give as good results as seed selected in the manner above outlined. It appears to be at least fair to expect an increase of five bushels an acre from seed properly selected above what is known as crib seed. If such were true, the one day's work of selecting enough seed to plant 50 acres should increase the corn yield on the 50 acres by 250 bushels! Not a bad day's work for doing what one really should do.

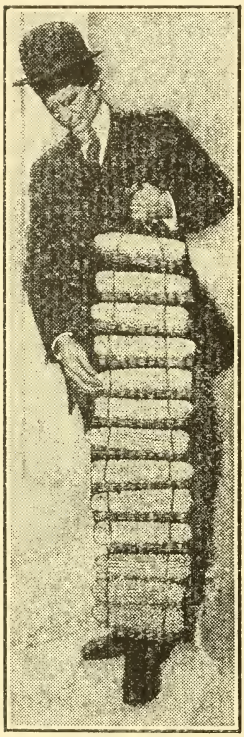


FIG. 5—STRINGING SEED CORN TO DRY

Ordinary binding twine is used and the string is hung on a nail in the rafter of the barn, where plenty of air current cures the corn before it freezes.

As soon as the seed has been gathered from the field it should be stored in a dry,

well-ventilated place, Fig. 5. It should not be left in sacks, boxes or barrels for even a few hours in warm, moist weather. Heating would thus begin in a very short time, and while the vitality of the grains might not be destroyed it certainly would be injured.

It is usually advisable not to shell seed corn until near the time of planting; also to reject the irregular grains on both butts and tips of the ears. In hanging seed corn it should be placed well out of reach of mice or rats. As a general rule a mouse-eaten grain should never be planted. These might grow under testing-box conditions, but are very unlikely to grow under field conditions. When one is thus selecting seed it is well to put some mark on a number of ears that most nearly approach the standard we have established. If from 25 to 50 ears be so selected, it is well the following year to establish with these our corn-breeding plat.

CHAPTER II

The Corn-Breeding Plat

A breeding plat of perhaps one-half or two-thirds of an acre will produce plenty of seed for the average farm. The ground should be of from medium to good quality, or at least a fair average of the corn land of the farm. It is also well to select it but a short distance from the house, as it will be more convenient to look after the various details of the work if so located. It should be as far from other corn as it can conveniently be placed. Since our prevailing winds are from a southwesterly direction during the pollinating period, it is well to have this patch, if it can be so arranged, as far in a southwest direction from the other corn as possible, to avoid mixing with other corn.

The soil should be as uniform as possible in both form and quality, so as to give every ear an equal chance. Every operation that is performed on the plat should be completed the same day begun. The reason is that sometimes work done on the ground one day will have a different effect than if done on another day. When the ground is ready for planting, enough corn should be shelled from the side of one ear to plant one row. The ear should be marked according to the row that it planted. Every row should thus be planted from a separate ear and every ear marked according to its row, and the remaining parts of ears put away carefully in a mouseproof box. These should be taken care of, because in the fall when we gather the crop and make our estimates of yields, it will be most inter-

esting to go back to the box and examine the ears that made the various records.

This first year every row should be treated alike, as the object the first year is to discover the high-producing ears. It will be found that variations, many times running from five to 20 bushels per acre, will be found. In the number of ears planted we may find that from 10 to 20 of them have produced considerably above the average of the plat. These

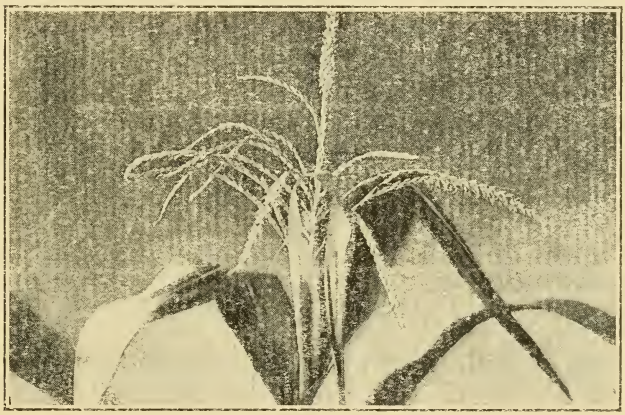


FIG. 6—TASSEL JUST APPEARING

high-yielding ears, then, should be carefully preserved and what corn remains on them planted in a propagating patch for the succeeding year. By planting these 10 to 20 high-yielding ears that we have found, and then during the season removing every undesirable plant from the plat, we will be able to get the highest possible quality of corn.

The above work as outlined is intended only for the beginner in corn breeding. Determining

the difference in the yield between the butt half and the tip half of tapering ears, detasseling alternate rows and other things that the veteran corn breeder understands, will be practiced as his experience and necessities may warrant.

We remove the tassels, Fig. 6, from undesirable stalks as suggested above for the reason that the

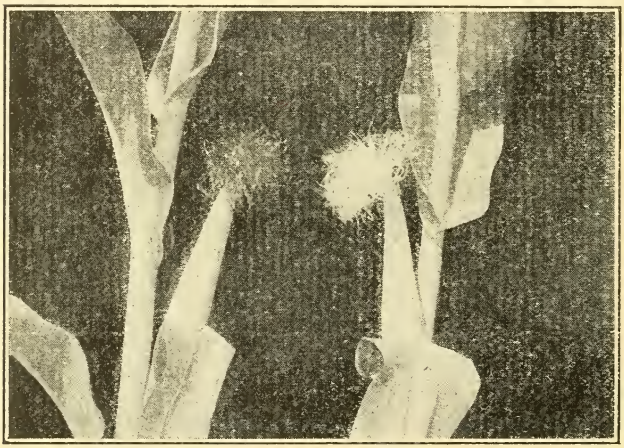


FIG. 7—A RED SILK AND A WHITE ONE

tassel is the male portion of the corn blossom. The pollen or brown dust is the male element of the corn blossom and the silk is the female organ. When a grain of pollen falls in the end of a thread of silk a growth sets up, passing down the thread of silk to where it is attached to what is known as the ovule on the cob. This action causes the grain to form. If no pollen fell upon the silk, Fig. 7, no grains would form. If the pollen from undesirable stalks falls upon the silk of a seed ear, every grain so pollinated will stand at least one chance in two to produce a

plant no better than the one from which the grain was pollinated. This principle is the same as eliminating the undesirable males from our live stock.

It will be found in making up our estimates that the fanciest ears, Fig. 8, are not necessarily the best producers, yet we will find that the good producer

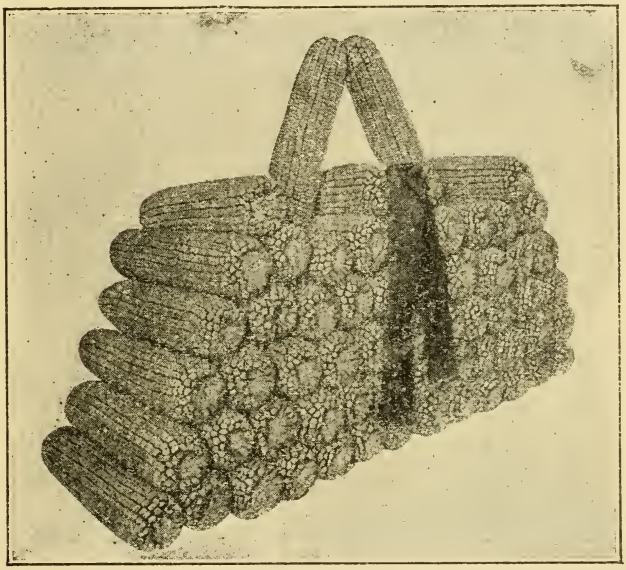


FIG. 8—A PRIZE BUSHEL

has, as a rule, a great majority of the points to be desired in a fancy ear. It will be found also that ears of good form will average better under the same conditions than ears of poor form. Since the grain, however, is apparently the unit of production and breeding, we will never obtain the most desired end in seed corn breeding until we take up the work with the individual grain rather than the individual ear.

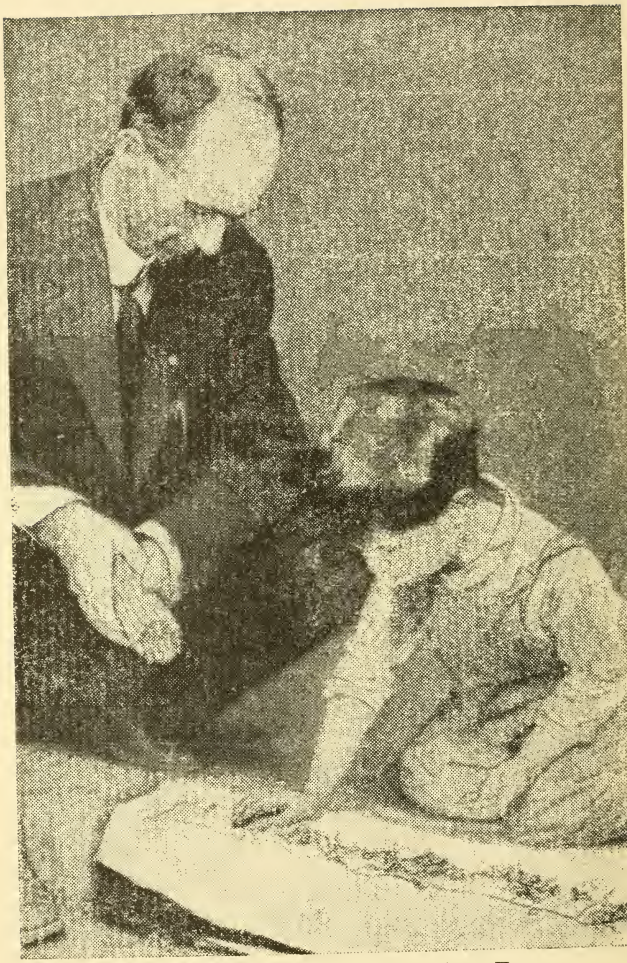
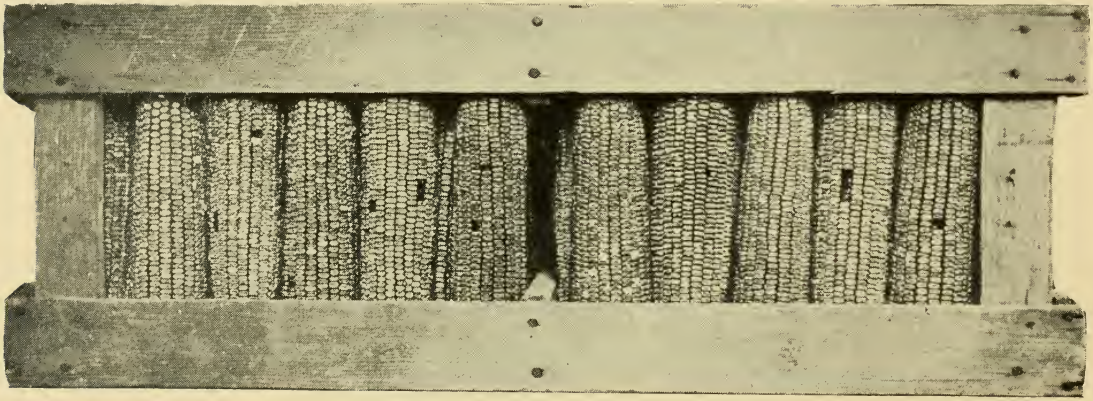


FIG. 9—PICKING OUT THE GOOD SEED EARS



A Bushel of Seed Corn Crated for Shipment

Cowpeas in the Corn

CHAPTER III

Seed Testing

Since the discussion has been confined to seed up to the present time, it is well to consider the matter of testing individual ears. Various methods have been followed by corn growers for a long time in attempting to determine the viability of a grain of corn. We can usually give a very good guess, but a guess is all it amounts to in the end. When I find a person who feels very sure that he can always determine whether or not a grain will grow by examining that grain, I feel just as certain that that same person never did any individual ear testing. If he had done so, he would have discovered the fact that many times the ear selected as a favorite falls short, and just as often an ear that he had perhaps condemned would make good.

That a seed grain will grow is not quite enough. That it will grow with great vigor is what we should ascertain. Seed corn that has been frosted before it was very dry may not have the germs killed, but they are very likely to be materially weakened. It should be evident that a grain with a weak germ could not produce as good a plant as if it had had a strong germ. While the grains from the frosted ear may grow, a poor plant will possibly be the result, with either a small ear or no ear at all.

The testing box or some modern method of testing should be resorted to in every case where the corn has not been well matured and dried out before hard freezing occurs, or where the corn has been allowed to heat. A common method of testing is what

is known as the rag-baby test. This is made of an ordinary piece of cloth according to the illustration.

Such an arrangement of the cloth can be made that any number of ears can be tested, but it is recommended to have each tester contain tests from 20 to 48 ears. When these are put in they should be wrapped rather closely, and after a thorough moistening should be covered with damp sawdust. The test should then be kept in a room about the temperature of a living room for from four to six days, when they may be opened up and results noted. Care should be taken to have the ears so arranged that they will not become mixed, as we want to remove those that have failed to make the right showing in the test.

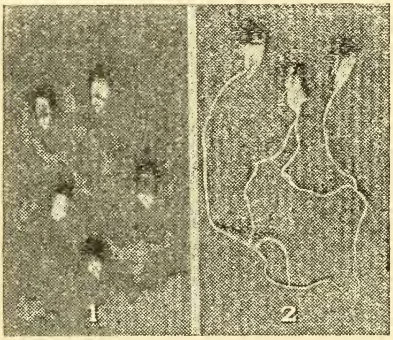


FIG. 10—RESULT OF RAG BABY TEST

No. 1, dead; No. 2, weak roots only.

Sometimes a common egg case is used. A layer of cardboard is placed in the bottom and the grains from each separate ear placed in a separate section. The sections can then be filled with damp sawdust, another card laid on and another layer of sections filled in the same manner until the case is full. The top may then be fastened and the test kept at the temperature indicated above. When it is ready to be opened, turn the case upside down and remove the bottom. The grains appear on the top of each section and the results are easily noted.

This testing is easily done and perhaps should not be undertaken earlier than March. The boys and girls often take a great interest in it and do the work very nicely. Sometimes the school gives this work as a part of the instruction by the teachers. The way they commonly do is to give each boy a rag-baby tester, made by the teacher and pupils, and it is well usually to send the boys, perhaps in pairs, making a test of the various samples of seed corn in the district. If from 10 to 20 ears of every farmer's corn is tested in this manner the results should give each one an excellent idea as to whether or not it is wise for him to test all of his corn.

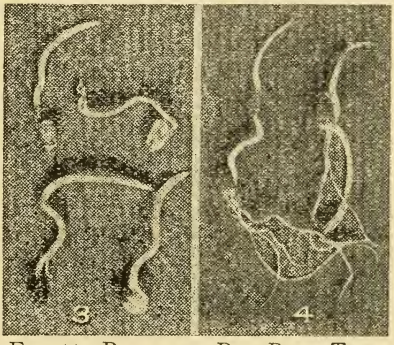


FIG. 11—RESULT OF RAG BABY TEST
No. 3, weak sprouts only; No. 4, strong, both roots and sprouts.

Where seed has been selected as was outlined in a former chapter, and this done before heavy frosts, and the seed stored rightly and well dried out, there is usually not very much use for testing. Practically every grain of this corn will grow, and grow well.

CHAPTER IV

The Seed Bed

It is well known by the best tillers of the soil and has been true in all countries and times, that the proper preparation of the seed bed is one of the chief factors in heavy crop production. It is commonly very difficult to prepare a good seed bed from a poor soil; consequently, to get the seed bed as it should be requires a good, fertile soil.

Since corn roots feed rather deeply and require a great deal of moisture, it is evident that a deep seed bed is necessary. One of the most common mistakes in the preparation of ground for corn is too shallow plowing. Shallow plowing also induces soil washing much more than does deep plowing. A seed bed three inches in depth will hold but a small amount of moisture before the water begins to run, carrying the soil with it. A seed bed six inches deep holds practically twice as much water before washing begins and a seed bed 12 inches deep holds an enormous amount of water. If it were from 14 to 18 inches in depth, it would hold practically any rain that ever falls without washing.

It should be remembered that very rarely do we have enough rainfall during the corn-growing season to make a crop of corn. It is thus evident that our corn crop is measured to a considerable degree, except in drouth years, by the amount of moisture we can store in the soil during the fall, winter and early spring. Too much plowing is done at a depth of four to five inches. The farmer who thus plows perhaps thinks he is plowing from six to eight inches, but when the measure is

put on the depth of his furrow, he is usually surprised to learn that he is not plowing more than half the depth that he had thought.

Another incorrect practice is to plow at about the same depth year after year. When this is done, the plowshare, moving through the damp soil and the feet of the horses tramping every furrow, makes a very compact, hard layer on the furrow bottom that is almost impervious to water. Some method of subsoiling or deep plowing should be resorted to to break up this layer, allowing the water to permeate to greater depths.

On many of our soils there is exceptionally great virtue in the deep-tilling machinery that can now be found on the market. Whether to plow in spring or fall we must determine by varying conditions. The advantages of fall plowing are that it divides our work, allows us to almost always get a good seed bed in the spring and sometimes gives us an opportunity to give the ground a green manuring of either weeds or some crop planted for that purpose. Very late fall plowing or winter plowing is one of the effectual ways to destroy vast numbers of insects.

Whether fall plowing or spring plowing will be the best in case of subsequent drouth is determined very largely by the amount of moisture received between the time of plowing and preparing the ground in the spring. If the weather is very dry, the ground will perhaps dry out worse by being plowed than if not plowed, while if there is a great deal of moisture during the winter, more moisture, of course, will be taken up by plowed ground than by unplowed. Since we cannot forecast the weather, chances must be taken in this matter.

We must determine whether to plow early or late in the fall by the amount of other work at hand, by

whether or not we have a green crop to plow under, or whether we are plowing chiefly to destroy insects. Another advantage of fall plowing is that we can plow as deeply as we desire and if some rather stiff clay is brought to the surface the freezing and thawing of winter will put it in good condition.

Spring plowing is sometimes chosen for ground that is very full of weeds, or where a crop was grown that we desired to pasture during the winter and so could not plow in the fall. Sometimes also the tendency of the soil to wash away has to be a determining factor.

When spring plowing is to be done, the first implement that should be used is the disk or a spring tooth harrow, or something that will thoroughly work the surface from one to three inches deep. In sod land, where a disk will work, a thorough disking of the sod before plowing will give very satisfactory results. The disk should always be lapped half in all such work. By going over the ground from one to three times in this manner before plowing is attempted, it will be found that the plow can be set much deeper without increase in the draft. The ground will plow up much better than if the disking had not been done.

In disking sod the surface is well cut up, and then when the furrow slice is turned and the disk put on again the seed bed from top to bottom can be well pulverized. The greatest difference in the draft of the plow, perhaps, will be noticed in plowing sod. The plow will commonly pull one-fourth lighter. If the ground has been well disked in spring and we cannot do the plowing until late in the season, as is many times the case, it will be found that this disked ground will plow up loose and mellow, when ground not so handled will plow up very hard and cloddy.

Disking conserves the moisture which in nearly every case at this season of the year is highly essen-

tial. In spring plowing there is great wisdom in harrowing after the plow twice a day. "Clods can't grow corn," and because this is true many an otherwise good soil, planted with good seed and upon which a great amount of work has been expended has produced more or less disappointing results.

I was once remonstrating with a man who was stirring his field of dry clods with a disk harrow. His team was working very hard, as their condition plainly indicated. I suggested to him that if he had disked his ground 10 days or two weeks before attempting to plow it, he wouldn't have had such a cloddy field. He began to complain that he couldn't do that because of his lack of horsepower. I suggested that if he had disked the ground before plowing it would have been much easier on his team, as the ground would have been so much easier to walk over; it would have made the soil so that it would not have broken up cloddy; also that he could have plowed his ground two inches deeper with the same draft.

Here was certain evidence to this man that he was using methods that were much more difficult for his horses than had he used the disk first and then plowed the ground. Then just once over with a drag harrow would have put his seed bed in most excellent condition. But he had done the work and the season was very dry, so while the soil was naturally good he didn't realize 25 bushels of corn to the acre. He had planted good seed, and had his ground been rightly prepared, with the good cultivation he had given, he should have realized at least 50 bushels.

Remember that when the corn is planted, good seed used and the seed bed is in ideal condition, the big end of growing a corn crop is done. The subsequent work is a pleasure because it can be well done, and always attracts the eye of those who look over the fence.

CHAPTER V

Varieties and Color of Corn

The most that can be said about varieties is that nothing but a trial of different varieties under the same conditions of soil and care can tell which is best. We too often draw conclusions on this matter by comparing our own corn with that of our neighbor. That is entirely unsatisfactory. The only reasonable way to determine this is to select a piece of uniformly fertile land and try the different sorts by preparing the ground in the same way, planting the corn at the same time, by the same methods and doing the subsequent work all alike. This work carried out for one year will not tell the story, as one season one variety of corn seems to do better than another, while in some other season the reverse may be true. The trial of varieties should be carried through a period of at least three years. The University of Missouri has been directing a number of trials in this state for several years and a wide variation with different sorts in different localities is found. In some sections Boone County White has seemed to be the heaviest yielder; in other places the St. Charles varieties are more favored, and in many places Reid's Yellow Dent has seemed to be the best on the average; Commercial White has been a high yielder in many sections. It must be concluded, therefore, that the only way for a community to determine the corn best adapted to its average soil is by very careful experimenting.

A great many people hold to the opinion that the white varieties of corn will do better in old land and in the drouth years than will corn of other colors. This

may be true of some varieties of white corn, as some of them have a very heavy plant in proportion to the grain produced. The length and width of the blades, together with the extent of the root system, are no doubt determining factors. It is evident, however, that if corn of any color has been given much care in the selection of seed for a few years, seed ears being taken only from short-jointed, well-rooted stalks, that corn will stand the dry weather better than any variety or color selected in the way commonly done.

In surveying fields in various parts of the country it is difficult to reach any conclusion as to whether

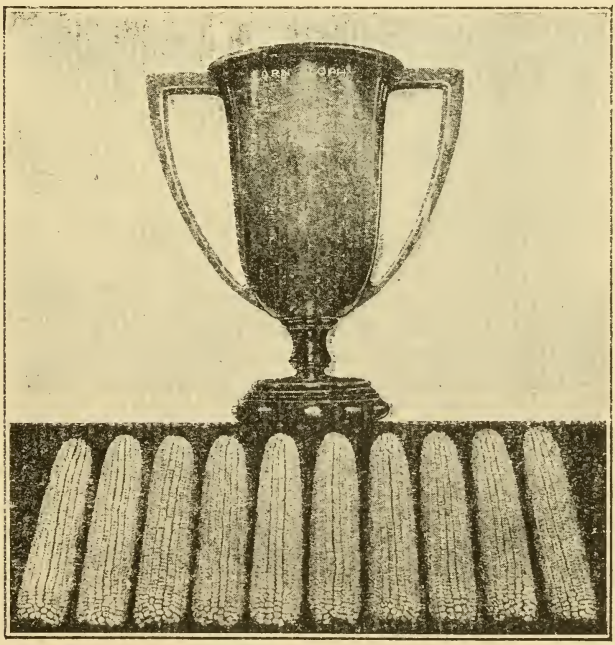


FIG. 12—JOHNSON CO. WHITE AND THE CUP IT WON

the white or the yellow is standing the drouth best. This ability of corn is measured more by the quality of the soil, the way the seed bed has been prepared, and the way the cultivation has been done. It should be very evident that there is no great virtue in pinning one's faith to the color of corn so far as yield or drouth resistance is concerned, but rather to the quality of the plants on which the seed grew and to the breeding of the corn.

With reference to feeding value, I am not aware that corn of one color necessarily has a higher feeding value than of the other. The feeding value is determined by chemical content, not by color. One white corn might be high in oil and low in protein, and another white corn high in protein and low in oil. That which was high in oil would be the better fattening corn and that high in protein would more nearly approach a balanced ration.

It is usually considered that corn that is high in protein is usually a little hardier than the same variety that is bred for high oil, while the high oil corn is usually thought to produce a little heavier yields. Perhaps the greatest number of feeders, if they have a preference as to the color of corn, would prefer the yellow varieties. Some have concluded that this is because it may be more palatable than the white varieties, but it appears very evident that if the yellow corn is a little softer and can be masticated easier, stock will prefer it, especially when they have all the feed they desire. Its being softer would allow better mastication and there would be less waste from feeding the corn whose grains were not so hard. It is perhaps true that the grains of yellow corn are a little softer and less flinty than those of the white.

CHAPTER VI

Planting Methods

Methods of planting differ very widely with different localities. Perhaps the varying needs of the soil is one of the reasons for these differences, yet in many cases custom is one of the determining factors. Where any method has given fairly satisfactory results the general rule is that people are slow to adopt changes. There is perhaps no great need of changing methods of planting in order to take better care of the soil, but to make more changes in the cropping systems.

The method known as listing finds favor in many places, especially in the drier regions. In soil that does not give trouble with washing this method, when rightly practiced, is highly satisfactory. This is especially true if what is known as double-listing is done and the work done commonly in the fall or very early spring. This allows the ground to lie for some time in the rough state, so that the deep furrows will hold the water, that it may soak into the soil.

The lister is a machine that throws the furrow to both right and left at the same time, leaving alternate ditches and ridges. The ground should be first listed very deep, then the ridges listed two or three inches shallower, and then a harrow run in the direction of the ridges, allowing the field to remain in this condition during the winter. When spring comes a little harrowing will keep down weeds and break the crust. This treatment makes it possible to store an enormous amount of the water in the soil for the subsequent use of the corn.

In the drier localities the corn crop is usually

measured very largely by the amount of water that can be stored in the soil before planting is done. Except in very wet lands the corn is drilled in the bottom of the furrow. There are very few sections where listing is done where they drill the corn on the ridge rather than in the furrow. In such localities, however, good crops of corn are practically out of the question. This method, the same as any other, has its advantages and disadvantages.

The chief advantages are the good condition in which the ground is left if the work is done in the fall or very early spring. If the ground be level or the furrows made on the level, much water can be stored in the soil. Other advantages are that the work is rapidly done and the corn set a little deeper in the ground. Some claim that listed corn is easier tended than corn planted by any other method, but there are many, however, who could never be convinced that this is true.

The disadvantages of the lister are that on land that is inclined to wash badly this method will perhaps allow more washing than any other. Another disadvantage is that the seed being placed in the very cold ground that has not been stirred nor aerated nor warmed, makes the early corn quite slow, and there is considerable damage by cutworms. Sometimes we suffer loss by corn being washed out by the water running in the furrow or drowned by water standing in it.

Another method is one known as furrowing out, or the furrow-opener method. This is where the ground has been plowed and harrowed down and the seed bed made ready. The furrowing out is sometimes done with an implement made for the purpose and only a shallow furrow made. It is sometimes done by fastening a double disk to each shoe of the planter. By this method all clods and trash are thrown

from the furrow, the corn is planted at a uniform depth at a very good distance below the level of the surface, yet not covered so deeply as we commonly find in what is known as surface planting.

The disadvantage of this method is that it allows a little more washing than the surface methods would do and in a very wet time on level ground water standing in the furrows drowns the corn. All in all, on average ground, this method is to be highly recommended.

The greater number of people, however, practice what is known as the surface method. The ground is well prepared and made smooth and the planter passes over the surface without any furrows. This method is the most satisfactory because the least washing occurs, and that is one of the things to be guarded against. There are perhaps two possible objections that can be reasonably made about this method. One is that we often cover the corn with too much soil, and if the weather happens to be a little wet and cold the corn is likely not to germinate. Another is that in order to keep the weeds from the hill a little more ridging must be done than is desirable, especially on rolling land, when the season is dry. The advantages are chiefly in preventing washing and the ease with which the work is done.

CHAPTER VII

Methods of Dropping

The two methods of dropping the corn are commonly referred to as hilling and drilling. Neither method has all the advantages nor all the disadvantages. The advantage of drilling is that it saves a little time. If weather and soil conditions were such that weeds could be kept out of the drill rows without so much cultivation as to ridge the corn too much, it might be that more corn could be grown to the acre by this method than by hilling, since it is more evenly distributed.

There is some discussion as to whether hilled corn or drilled corn stands wind better. Some claim that the hills permit the wind to pass through or among them without blowing the corn down better than drilled corn will do. Others claim that the hill catches more wind than a single stalk, consequently hilled corn will more easily blow down. It is my impression that the method makes very little difference. Some winds will blow down any corn. A field with a poorly developed root system, which is usually the case in a poorly prepared soil, will blow down much more readily than where the root system of the plants is strong. In the selection of seed through all the years of corn growing, comparatively little attention has been given to the root system of the plant from which the seed ear is taken.

Another cause of corn blowing down badly is that the roots have been cut off either by worms or by cultivators. Deep cultivation late in the season is entirely

wrong when possible to avoid it, for this reason if for no other. Corn roots come very close to the surface and the less they are disturbed the better.

The advantages of dropping in hills are chiefly that we take fewer risks by this method than any other through being able to do cross plowing, and in a season in which the weeds grow vigorously there is perhaps no doubt that corn can be kept cleaner than when drilled. In a dry year we like to cultivate as often as possible, and when we can cross plow we can prevent ridging, which is usually all wrong, especially in a dry season and on rolling land.

CHAPTER VIII

When and How Thick to Plant

The thickness of planting should be determined by the average moisture, quality of the soil and size or earliness of the corn. Rows are most commonly put about 3 feet 6 inches to 3 feet 8 inches apart. On an average perhaps 3 feet 8 inches, with three average grains to the hill, gives best results, so far as yield is concerned, in the richer land.

In thin land the practice is to put the hills 3½ feet apart, with not to exceed two good grains to a hill. There are just a few who contend that corn rows should be much wider, allowing more sunshine to reach the ground in the earlier stages of growth or up to the time of laying by. When the heated and dry season comes on, however, these wide surfaces exposed to the sunshine and wind would no doubt work detriment to the corn. This is overcome by planting cowpeas between the rows, so as to shade the ground during the latter part of the season. This planting is done at the time the corn is laid by.

When the rows are put further apart a greater number of grains are dropped in the drill row. Farmers who have tried the method have been very well pleased with it. Where the ground is not pretty well shaded from the middle of July on, however, too much water escapes from the ground through evaporation. This raises a point that will be discussed in a later chapter where the subject of growing cowpeas and soybeans in corn is considered.

The number of grains per hill, as well as the width of rows, must also be determined by the varieties of

Soy Beans Planted with the Corn

An attachment to the corn planter is used and the entire crop is to be put in the silo.

Cowpeas Growing Between the Rows of Corn

They were sown at the last cultivation and will make fine pasture when the corn is removed.

corn. For instance, we could plant popcorn more thickly than we would dare plant Boone County White in the same soil. Early corn is usually smaller than late corn and consequently can be planted more thickly. From three to four grains per hill in rich land gives perhaps more bushels of corn than two to three grains, yet we no doubt get fancier ears by dropping the latter number. Planting big corn in thin soil compares very favorably with hitching a pony to a log wagon. The number of grains as well as the variety of corn should be determined very largely by the quality of the soil in which we are planting.

There are two sorts of opinions on the subject of the proper time for planting. We find some who desire always to plant early; others like to do a great deal of work on the seed bed and plant very late. If we could forecast the season, we could tell exactly what to do in such a case, but since one season will favor early planting and another very late planting, we have the two ideas prevalent.

It sometimes happens that where cutworms or wire worms are not giving trouble, early planting is most satisfactory, yet usually early planting of sod land that has been plowed up from clover, timothy or blue grass means the loss of the seed. Where the ground is badly infested with insects more or less trouble can be expected until very late planting time. Under such conditions it is most often the best to do just as much work on the ground as possible, destroying all the feed on which these pests live and thus destroying a vast number of them, and to plant the corn very late. We commonly find the wire worm worse in timothy sod.

Where sod lands are put to corn the plowing should be done late in the fall if at all possible. If not, then as early as possible in spring. These pests will live more or less on the grass roots that may be alive

and new vegetation that may start, and if fall plowing is done and a great deal of spring plowing accomplished, the vegetation is practically all destroyed, with resulting great destruction of the insects.

Root lice are often very bad in the plowed-up clover field. Thorough work on the ground, keeping down all vegetation until medium late planting time, is a very effective way of combating insects of this kind.

Sometimes early planted corn is beginning to tassel when hot weather begins. Under such conditions late planting is a little better, but sometimes the hot winds begin when late corn is tasseling and in this event early corn has the advantage. Where early planting can be done perhaps the best quality of seed corn, on an average, can be secured from these fields, as it is commonly well matured and dry before the first frost occurs. Although the very early planting may be caught by a late spring frost, it is commonly out of danger of early fall frost.

CHAPTER IX

Cultivation

When the seed has been properly prepared and selected, the seed bed work done, and the corn rightly planted, our work to a very great degree is accomplished. Another great factor in corn production is proper cultivation. While, of course, it must be conceded that the corn crop is measured very largely by the rainfall, the moisture can be controlled, in a measure, by the man who is doing the work. We had abundant evidence of this fact in the years 1901, 1911 and 1913 at many points in the corn belt. In these years where all parts of the farmer's work was well done it was almost wonderful how those crops of corn stood the dry weather and fierce heat. It was also noticeable that in fields in which the fertility of the soil had been lost, the humus exhausted, the seed bed poorly prepared, low quality seed used, or incorrect methods of cultivation employed, very discouraging results followed.

While no one way is best all the time and everywhere, there are certain well-defined principles upon which we can rely and from which we should be able to draw logical conclusions as to what methods are best under the circumstances and conditions we may have at hand. Each man to a very great degree must be his own judge in the matter, for no specific rules can be laid down. A plan that works well one year may be entirely wrong in a different year. Too often it occurs that some person having a fixed way of cultivating corn will cultivate it that way no matter what

may be the soil or season. Usually these are the persons who make the greatest number of failures. During the terrific drouths of the years above mentioned, I found that in very many places—in fact, in thousands of fields—wet weather methods were being employed.

It certainly should seem clear that the season, the depth of the soil or the kind of soil and the lay of the land should make it possible for any man to adopt methods that most nearly meet the conditions at hand. We find many very flat lands with a highly impervious soil in which about the only safe method is to drill the corn. For the sake of the future condition of the soil of such fields it seems necessary to do at least a little ridging during the period of cultivation. If this is not done, when the wet season begins or if the season be wet, the corn is likely to drown. When such land is kept perfectly flat during the season it makes it very difficult to handle the following spring.

It can be laid down as a very general rule that ridging on rolling or washy land is not the best method, no matter what may be the season. It is also a well known principle that by stirring the surface of the ground often during a dry time moisture is retained in the soil better than if no cultivation is done. For this reason we find good results by what is known as after-cultivation for the purpose of conserving moisture in very dry weather.

CHAPTER X

Tools Employed in Cultivation

Ideas vary widely in a great many phases of corn cultivation, especially as to tools. It appears evident that one difficulty is standing in the way, and that is that the average man hardly feels justified or able to buy the necessary machinery to do the best work in growing his crop. It is a fundamental principle also that to make the success that a farmer would like to make plenty of power and plenty of machinery is positively necessary. On a small farm where one or two men may be doing the work, one corn-tilling machine will be supplied each, and all the work from the first to the last cultivation is done with the same tools.

Hardly a year passes when best results can be secured with but one implement with which to do the cultivating. The word of 10 men who have tried a thing and found it good is worth more than the word of 1,000 men who have never tried that same thing, but who condemn it.

Farmers who use what is known as the weeder are almost a unit in praising this tool for the first two or three cultivations. Many of our best farmers are partial to the harrow for this same reason. There is another school of agriculturists who begin with the cultivator and end with the cultivator when the corn gets so high that they are likely to break some of it down, and no other tool is used. In listed corn various tools are used the first time or two over with more or less satisfaction. In many soils when the season is dry enough to justify and the furrow opener has been used,

the roller is the first tool employed. Then a harrow, or preferably a very small shovel cultivator, can be employed with gratifying results. The type of soil determines to a very great degree the type of machine to use. The cultivator perhaps most in favor is the one having the three-shovel gang. If only one tool is employed in cultivation this perhaps is as good an average as we can find.

In my own experience the favorite tool under the greatest number of conditions has been the one with the five-shovel gang, the shovels being very small, or the plow that is known as the spring-tooth gang. This machine, however, is unsatisfactory where the ground is very hard or the weeds very high. Where the ground can be kept in anything like good condition, this machine meets the requirements most excellently. There are yet some who prefer the old time two-shovel gang with large shovels.

There are perhaps a few sections of the country where the soil does not break easily, the ground being level and the land such as is commonly called poor land. This is where the big shovel is most in favor. The disk cultivator is about as good as can be found in such sections and under conditions that ridging is advisable. Ridging can then be done if the disks are not set deep enough to injure the roots of the corn very much.

An objection to the disk, in addition to its ridging the ground too much, is that it leaves more or less of a hard center between the rows and exposes many roots in that position. This hard center is likely to crack badly in a dry time, and when the ground cracks water is escaping at a very rapid rate from the openings during the heat of a windy day.

Most of the disk cultivators are made with parts to level the ground back after it has once been thrown

toward the row, yet perhaps 99 farmers out of every 100 remove these levelers and do not use them at all. When the disk cultivator is employed the first time I run the disks very close to the row, moving the soil slightly away from the row. This is commonly called barring off. No mischief can result from this practice under any weather conditions if the soil is thrown back very shortly after being thrown away.

Where ridging is done with plows that have shovels the great difficulty is that the shovels are run so deeply into the ground that a vast number of corn roots are cut off. A number of years ago after-cultivation was many times practiced, using what was known as a diamond plow. This was a little turning plow, usually run not to exceed 1½ inches in depth. That would cut off the small weeds between the rows and cover those in the row. With a diamond plow not half the mischief was done to the roots that we find today with the shovel gang as it is sometimes used.

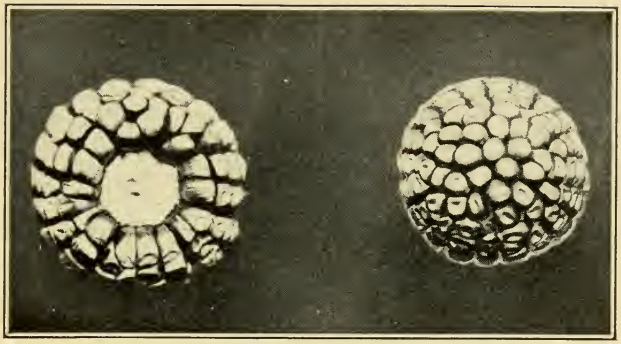
Years ago our soil was fertile, and about all we had to do was to stir the ground a little, put in the seed, cultivate a time or two and reap a generous harvest. This led to the rule of having a certain number of times to cultivate the corn. That time is now all past. Some years it is necessary to cultivate much more than it is other years. This is especially true of a very dry season. I used to cultivate corn three or four times and then quit, but now find it of advantage in very dry years to keep up some method of cultivation for a long time after the corn is too large to cultivate with an ordinary cultivator.

For this purpose a vast number of different sorts of machines have been employed. Sometimes what is known as the 14-tooth cultivator is used, sometimes a machine made for that particular purpose that is sold on the market; sometimes small boards made into

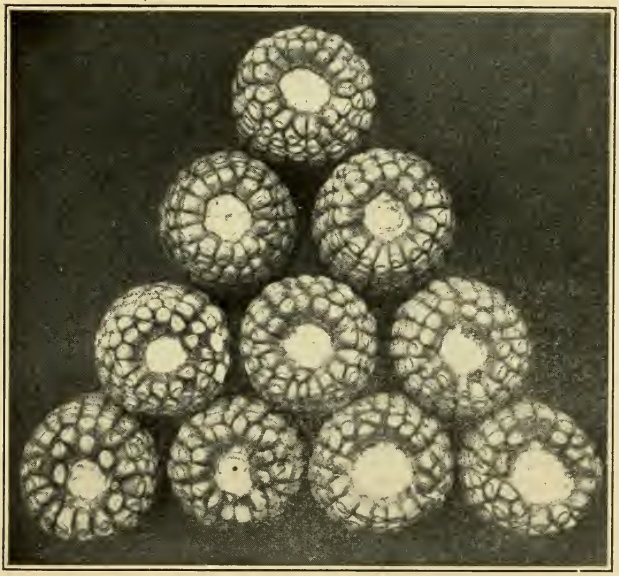
a drag; sometimes a corn planter wheel or a mower wheel or a forked tree made into an "A" harrow. It matters not what sort of machine may be used, provided one does not lose sight of a few fundamentals. One difficulty with the five-tooth garden plow or the 14-tooth cultivator is that we are likely to have the outside shovels set a little too deep and we tear out too many corn roots.

The mower wheel or the corn-planter wheel, while in many cases giving efficient service, yet certainly are not best, because they leave a perfectly smooth surface of dust. If this is done and a heavy beating rain begins, puddling of the surface will begin in a short time, and under such conditions the water soaks through very slowly and consequently begins running. Then, when the ground has dried off, this smooth surface bakes very hard and makes subsequent work unsatisfactory. We should have the clods smashed into dust, and if we could arrange a machine that would make the ground perfectly smooth yet leave creases in the dust behind the machine, we would undoubtedly have about what we need. This seems to be accomplished in what is known as the wooden float, which has a number of harrow teeth toward the back portion, slanting pretty well back. By putting the right amount of weight on this it smashes the clods and leaves a dust on the surface, yet the harrow teeth leave creases in the dust through which water can readily penetrate. When the ground dries off the very hard crust will be largely avoided.

Sometimes if the ground is left perfectly smooth with a dust covering a heavy rainfall leaves the ground in worse condition than if the dragging had not been done. This sometimes occurs under these conditions and at the season of the year that heavy winds accompany the rain. If the corn is blown down badly we

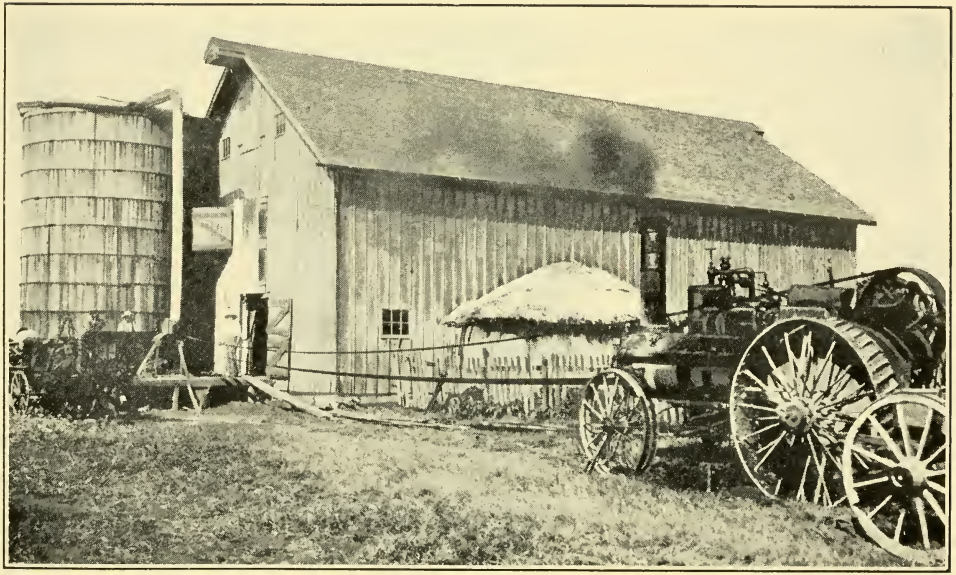


Very Fine Butt and Tip



How Butts of Show Ears Should Appear

Butts of champion ten ears of 1910 show, Yellow Dent.



A Great Way to Save Feed—Putting It in the Silo

cannot get through it again to plow the crust that forms, consequently some plan should be employed to make the least amount of crusting.

The crust that forms on the ground after a rain soon fills with cracks. This crust and the cracks let the water out into the air at a wonderfully rapid rate. The breaking of the crust and the filling of the cracks is much like spreading a blanket over the field to keep the water in. This after-cultivation is hardly necessary in a good year, but highly beneficial when the season is very dry. It was noticed in central Missouri in 1913 that in fields where level cultivation was practiced the corn stood the drouth much better than where ridged. For the first three weeks of the dry weather little difference could be noticed between the corn that had been after-cultivated and that which had not, but some 10 days or two weeks later that which had been after-cultivated was standing the drouth very much better.

During the drouth of 1911 every available means was employed to urge the work of after-cultivation; as a result all sorts of machines were used and perhaps as good work as was ever done in corn fields was done that year; as a result the corn was held in fair condition until the rains finally did come. The Missouri state average that year was 25.3 bushels an acre when the state average in 1901, with a drouth not so severe, was only a little more than nine bushels to the acre.

The number of times corn should be cultivated must always be determined by conditions as I have outlined above. The machines for cultivation should be such as will meet these conditions. When a drag is used for after-cultivation it is a common practice to make two of them, as one man can drive two horses, each one hitched to a drag, dragging two spaces each time through.

In seasons such as 1911 and 1913 in central Mis-

souri, thoroughly rolling the ground is highly beneficial. The roller, however, should be avoided when the ground is very moist. One of the best rollers that I have ever seen for such work as this is a corrugated roller from which the two central disks or wheels were removed and perhaps two from each end, thus permitting two spaces to be rolled without the machine running directly through the hill. This machine not only smashes the clods but avoids leaving the objectionable flat surface already discussed.

CHAPTER XI

Harvesting

When land is worth from $50 an acre to $200 or $300 an acre it looks like poor economy to work a season to grow a good crop and then waste about 40 per cent of it. This 40 per cent of the feed value of corn we find in the stalks. Where these are left standing in the field and only the grain harvested this is about the loss that we experience. The corn stalks, to be most valuable, should be put into the silo. It is thus rendered just as palatable as the green corn stalks, and we save practically the entire crop. By putting the corn into the silo a good deal of labor and expense is incurred, but it all comes at one time and is over quickly, leaving plenty of time for fall plowing, sowing fall crops, repairing fences, painting barn or house, trimming orchards or doing other work as we find most need for doing.

It is not likely that all farmers would have use for all the corn stalks they grow if put into the silo, but the fact remains that practically every year in every neighborhood much stock is half starved through the winter and goes into the spring in producing young or doing work under very unfavorable conditions.

Corn that is left after the silo is filled may be cut into fodder, and fodder makes an excellent feed during the cold winter weather, especially when there is snow on the ground to keep it clean. While there is a good deal of waste from the corn stalks, they can be utilized to a most excellent advantage if the fodder is hauled out on the poorest places in the field or pasture and fed there for the purposes of building up the

soil. The one serious objection to cutting up corn for fodder is that by the common methods we have an all-winter's job. Enough, however, ought to be either put into the silo or the shock that we may be sure we have enough feed to supply our stock liberally until we can put them on grass in the spring.

If we have had enough fodder to feed through the winter until grass comes and have not touched the feed in the silo, there will very likely be a time beginning in July and lasting through August when the pastures are desperately short and dry, and this feed in the silo will come in fine play under such conditions.

There are two or three objections to leaving the stalks standing in the field in the winter time. One is that they furnish harbors for noxious insects, and while they furnish some vegetable matter if turned under, it would be better if they were put into the silo and the manure from the barn returned to the land. One of the serious objections is that we depend on the stalk field to feed our stock when many times they are suffering and hungry because they have to subsist on a ration that has little food value. The same type of farmer is usually out of feed in the spring, and he lets his stock tramp over the fields through the mud in search of feed. This tramping has a very bad effect on the field for the crops that are to follow. It is a bad practice to allow the live stock in the fields after the ground begins thawing in spring.

CHAPTER XII

Economy in Harvesting

We find many people who think it looks lazy to "snap" corn rather than remove it from the husks. There is an objection to cribbing corn with the husks on. It takes more crib room and feeding stock where the husks must be removed requires more time in feeding. Yet, when we count the economy of time in gathering corn and utilizing to the best possible advantage the fine autumn days for this work, we are fortunate indeed if we can gather it and have it all done before bad weather comes. Gathering corn out of the snow is no pleasant work. Some husk enough corn for the horses and "snap" the remainder for the hogs and cattle.

Corn left in the husk usually keeps very much cleaner and freer from rats and mice than when the husks are removed.

Where fodder is cut I have always been partial to the corn binder. This may seem to cost a little more while the work is going on, and it knocks off a few ears, and once in a while leaves a stalk, but corn in bundles is convenient for handling, and this is a very great item indeed when we remember that we must handle fodder on a great many days in winter. It is too often the case that when we depend on the man with the corn knife he will work a few days, and possibly when Saturday night comes and he receives his pay he leaves us with a promise to return Monday morning, but we never see him again. One of his most characteristic traits is to know how to charge enough for his work. If we desire to put the corn into the

silo, it is certainly great economy to use the binder. When the corn is in bundles and we have a low wagon or a fodder sled one man can handle the fodder to excellent advantage. For such work as this a low-wheeled wagon with a large platform is very desirable, as one can drive close to the shock and stand on the platform and load every shock until perhaps the last one.

CHAPTER XIII

Other Crops With Corn

In a good soil and a favorable season two crops are usually grown in the corn fields—one crop of corn and one of weeds. This fact led to the idea that some good crop can be grown in the corn just as well as weeds, and this good crop will have some value as feed, as fertilizer, and as keeping down the noxious weeds.

One crop sometimes grown in corn is Dwarf Essex Rape. This is commonly sown after the last cultivation, and if in a good soil, with reasonable weather, will make a great amount of feed for lambs or pigs that may be turned into the field. It will remain green until heavy frosts come.

The favorite crops, however, to grow in corn are cowpeas and soy beans. There are two methods by which this is done, and sometimes both cowpeas and soy beans are grown in the same field of corn. The erect habit of growth of the soy beans makes them desirable to grow in the hills, since they interfere less with cultivating than do cowpeas. If it is desired to put lambs or hogs in the field when the beans are ripe, some that have a low habit of growth such as the Mongul, Sable, or Ito-San, are very good. Where it is desired to put the corn and the beans into the silo, such varieties as Medium Yellow or Mammoth are preferable.

When cowpeas are put in the corn for the silo it is desirable to have some of the vining varieties that twine around the corn, in order that harvesting may be accomplished to the best advantage. Such varieties are Clay, Little Black, Groit, and Whippoorwill.

The sort used for planting in the hills in corn not to be put in the silo is the New Era, that being considered best, because it produces seed very heavily.

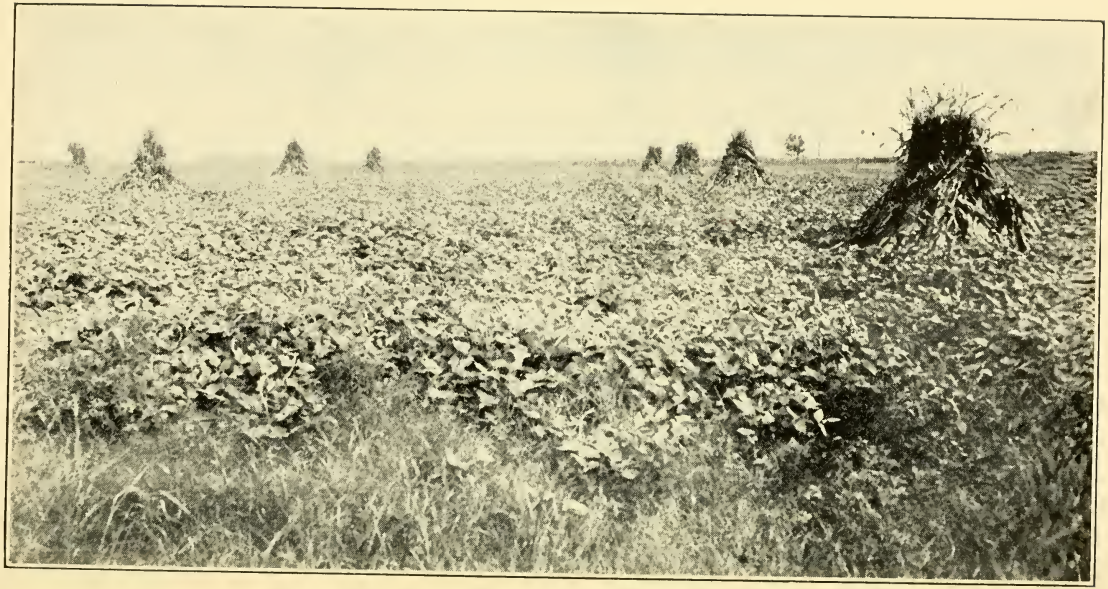
A method that is sometimes used with considerable success is to plant some of the early varieties, such as the New Era, between the rows of corn when the corn is laid by, or early in July in central Missouri. Sometimes a mistake is made in this by not planting early enough. If the corn shades the ground too much before they get a good start, they will not make much growth. The great value of these plants growing with the corn is the feed they make and the fertility they add to the soil. A third value is in holding weed growth in subjection.

The question often arises whether these crops growing in the corn injure the corn crop. Experiment stations have drawn the general conclusion that in a very dry year they perhaps injure the corn crop somewhat *if the weeds could otherwise be kept down.* Under average farm conditions, however, we find three answers to this question. I have asked for the experience of men before thousands of people for the past seven or eight years, and only three were found who said they believed their corn crops were injured by growing peas in them. Everyone said, however, that the difference was more than made up in the increased crop the next year through the fertility that had been added. The greatest number stated that they could see no difference, and there are a great many farmers who actually believe that the crop is benefited by cowpeas growing in the corn, even in the driest season.

During one week of the dry period in 1913 I traveled nearly 200 miles over all parts of Pettis County, Missouri, and on account of having urged farmers to grow cowpeas made careful and extensive observations. The conclusion must be drawn that in the fields with

A Soy Bean Field

The beans are about four weeks old.



Soy Bean Pasture Left After the Corn Is Removed

cowpeas growing in the corn the corn is found during the drouth, on an average, better than the fields without cowpeas. The reason seems to be that while the cowpeas require very little moisture, they at the same time shade the ground completely. During the days of intense heat and heavy winds much more water is lost from the surface of the ground exposed to the sunshine and wind than is removed by the cowpeas.

It is well remembered by a great many who grow pumpkins that commonly where the best pumpkins are found the best corn was grown. If there is any philosophy in this, it is certainly due to the fact that during the hot summer the ground is completely shaded by pumpkin vines. Weed growth, from this same cause, is prevented. Some of the varieties of soy beans when grown in the corn will produce almost as much feeding value for pigs or lambs as the corn crop itself, and so the practice of growing them in corn is to be highly recommended.

CHAPTER XIV

Increasing the Fertility While We Grow Corn

Reference has been made in another chapter to growing cowpeas and soy beans together with corn. It has usually been supposed that these plants were suitable only to the warmer sections of the corn belt, but they are certainly worth a trial in any region where corn is grown. There are two methods of planting, and sometimes both are used in the same field the same year. One is to drop the beans or peas in the hill with the corn at planting time, and the other to drill them between the corn rows at the time the corn is laid by.

Soy beans can be planted earlier than it is safe to plant cowpeas. A common practice is to put about the same number of soybeans or cowpeas per hill that we plant grains of corn. The variety of soy beans used should be determined largely by the use we are to make of the crop. Where cowpeas are sown between the rows it is necessary to lay the corn by a little earlier than otherwise in order that the peas may have enough sunshine to get a good start.

The most convenient way to plant cowpeas is with a one-horse grain drill made for drilling grains between rows of corn. This machine will lay the corn by and plant the peas at the same operation. New Era cowpeas are perhaps best for this purpose, and in medium to rich land about three rows in each space will be sufficient. Where the land is rather poor, for the purpose of fertilizing, five rows in each space is better. Seeding in this way requires from a peck to a third of a bushel per acre.

About corn cutting time it is necessary to begin the harvest of the peas and beans in the corn, especially where the corn is not put into the silo. For this work of harvesting lambs are the very best. Usually from five to 15 head an acre can be fattened in about 60 days. The number and the time, of course, depend largely on the quality of the crop. Where lambs are thus turned into a field for a few days they should be allowed in just a little while at a time, as the green cowpeas and soy beans are laxative and trouble is likely to result.

Where there is plenty of grain on the beans and peas, pigs up to 75 pounds may be turned into the field, and they will do little or no damage to the corn as long as there are plenty of peas or beans. Before turning them in the field, however, some should be pulled for a few days and thrown over the fence into a dry lot, that the pigs may learn to like them.

Sometimes these crops are put in with the corn for fertilizing purposes only. When this is done, the forage on the ground is plowed under after the corn has been removed. If the entire crop could be fed down, it is quite evident that corn could be grown on the same land for many successive years, and in the average case the quality of the land be greatly improved. Both cowpeas and soy beans enrich the soil at a wonderfully rapid rate, in addition to the feed they produce. It is a fact that probably nine out of every 10 men at least who have given this work a trial are loud in praise of the practice.

CHAPTER XV

Corn as a Feed

On account of the convenience, ease and cheapness of corn it is perhaps the greatest favorite of all feeds. These things also have been instrumental in causing poor economy in methods of feeding. It too often happens that we resort to a feed of corn alone when a combination of feeds would be both economical and better for the animal.

As a single fattening feed corn has no superior for animals that we slaughter. As feed for horses, especially during summer time, it nearly always happens that too much corn is fed in proportion to other feed. It is very heating, making it one of the best winter feeds, but not so desirable as a summer feed. When mixed with wheat, barley or oats, corn makes an admirable feed for almost any kind of live stock, and nothing can take its place when we consider its cost.

Wheat or barley produces a finer quality meat than corn, owing to the fact that they produce more lean tissue and less of waste in fats. It has also been found that a bushel of wheat and a bushel of corn in combination produce results superior to either two bushels of wheat or two of corn fed separately. Wheat comes much more nearly feeding all of the body than does corn. It is rich in blood, bone and muscle-forming materials, consequently some such feed should be always mixed with corn when fed to young stock, unless they have access to such roughage as clover, alfalfa, cowpea or soy bean hay. When this roughage is used much less corn is needed in the ration than when other kinds of roughage are fed.

With a little green clover or alfalfa or blue grass as a pasture hogs can be fattened with very little more than half the expense incurred when fed on corn alone. Perhaps the greatest mistake that the farmer makes in all his feeding is when he feeds hogs on nothing but corn. Some other element should always be used if it is expected to make economical gains. Corn with a little tankage, a little oil meal or some milk, or with alfalfa or clover pasture makes a combination that will keep the pigs in good health and make good money for the feeder.

The question often comes up as to whether or not corn should be ground for feeding certain animals. It may never be entirely settled to the satisfaction of all, but it is the very general opinion that as a rule grinding the grain does not pay. Where one has his own machine and plenty of power to grind the corn with husk and cob for cattle, especially where hogs do not follow them, this seems to be excellent economy. Some claim that it is economical even though hogs do follow. While there is apparently very little food in the cob, it has a beneficial result by preventing an excess of highly nutritious food in the alimentary canal that possibly would have a tendency to disarrange the digestive organs.

The practice of soaking corn, especially old corn that is dry and hard, when fed to fattening stock, usually is to be recommended. If the soaking is properly done in clean water, it has a tendency to wash the dirt and dust from the corn, and to make it more easily masticated, as well as causing the animal to consume more water. It is always economy to prepare feed for a fattening animal in such a way that it consumes a great deal of water.

One of the most economical of all ways of feeding corn is by putting it through the silo. To be sure, re-

moving the stalks from the field removes a little fertility and a little vegetable matter, but when they are put into the silo a great many more head of stock can be handled than otherwise and much more manure produced in this way to be returned to the soil. When the manure goes back to the field it is far superior to the stalks we plow under, and we get returns from that fertility much more rapidly. It certainly will be a happy day when every farmer can put a part or all of his corn crop into the silo. Especially in drouthy years a great deal of feed may be thus taken care of that otherwise would be valueless.

Another favorite method of handling the corn crop, as far as feeding is concerned, is to allow the fattening herds to harvest it. It is the testimony of almost every man who ever "hogged down" corn that this is a most profitable practice. If soy beans are grown in the corn and a variety used that ripen about the same time the corn ripens, hogs or sheep or lambs turned into the field will make most wonderful gains. The sheep or lambs can be turned in about corn-cutting time, and when they are fattened out the hogs may be turned in to finish the work.

It often happens also that a field of corn can be gathered by steers that are being finished for the market if they are to be about ready at the same time with the corn. They can be turned in from a heavy feed of corn or heavy grass in the evening when perhaps they are not hungry and should be turned in when the corn is ripe. In a few days after that the fattening hogs may be turned in to follow them, and it will be found that the hogs destroy almost no corn. This would be done only in the event that there were too many hogs in proportion to the number of steers.

All this stock will make more rapid gains when they are doing their own feeding; at the same time they

are hauling their own manure and gathering the crop, and for husking they do not charge us four or five cents a bushel either. They assist us to solve the labor problem to a very great extent if we just give them the right kind of a chance. After the fattening herds have gone to market the stockers may be turned into the field to clean it up, and we find that practically no loss at all has occurred.

These methods are entirely practical where a man has his farm well fenced with hog-tight fence. Good fencing and plenty of it is one of the greatest economies of the farm.

CHAPTER XVI

Enemies of Corn

On account of the great value of corn and its palatability for almost every creature, it has perhaps as many enemies to contend with as has any other plant. Every plant-eating animal and almost every plant-eating insect likes it. In a discussion of this kind, however, we are chiefly concerned with those insect pests with which the corn grower must contend.

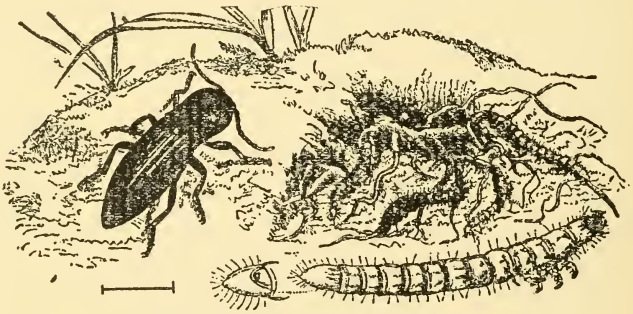
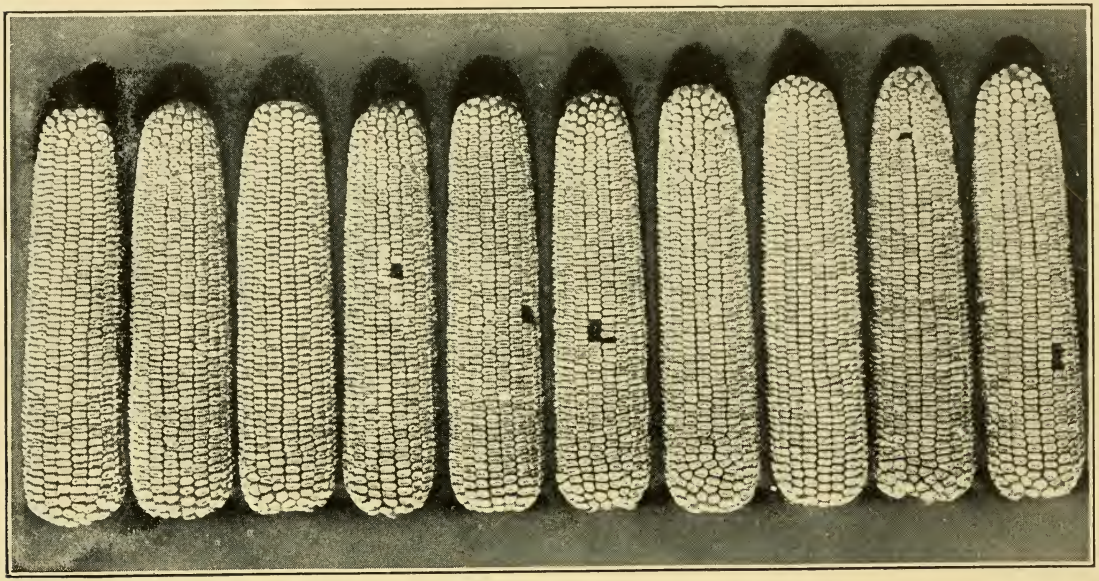


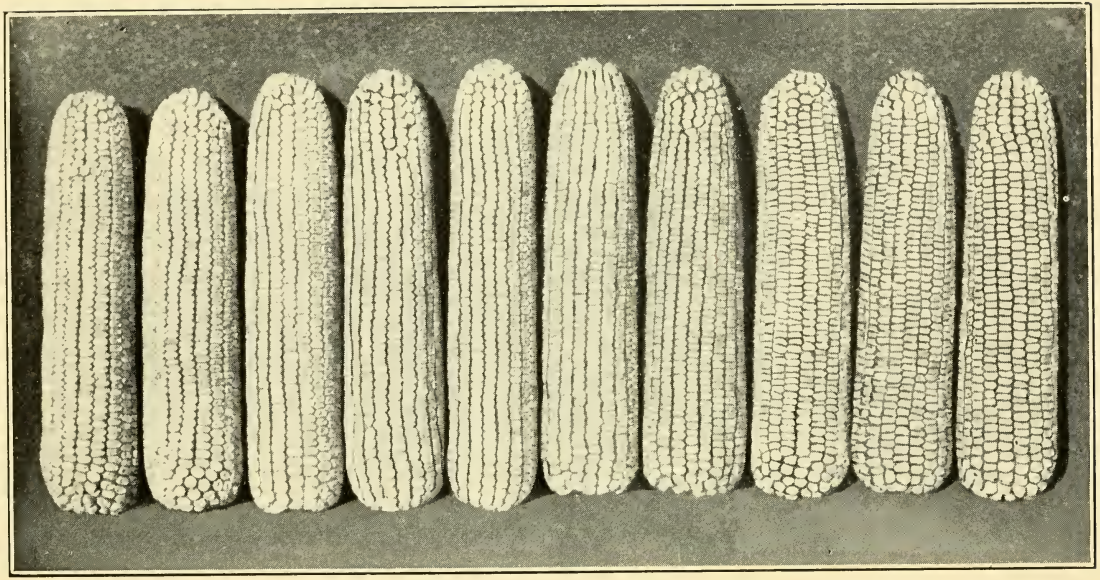
FIG. 13—A COMMON WIREWORM

Adult and larva, enlarged; and young larvæ feeding on roots of grass. The line below the beetle indicates its natural size.

One of these pests is the common wire worm, Fig. 13, a gray beetle known as the "click beetle"; almost every boy is familiar with this bug. When he is placed on his back, he gives a quick, jerking movement and throws himself clear of the ground, and as he alights he stands at least one chance in two of alighting on his feet. The insect should be recognized from the illus-



Champion Ten Ears of Reid's Yellow Dent



TEN EARS OF A HIGH-YIELDING STRAIN FROM MISSOURI

tration here given. The worm or larva is a slender, slick, yellowish worm that first attacks the grains of corn when planted, and later often attacks the growing plant. They can often be found sticking through the plant near the crown.

A worm that looks very much like the wire worm is often found under boxes and barrels in barns and other buildings, especially where grain of some sort has been stored. A little knowledge of the life history and habits of this pest will suggest ideas for combating it.

We find the wire worm giving us most trouble where timothy or blue grass meadows have been plowed up and the land put to corn. We find that the beetles almost always lay eggs among some of the grasses, and the worms when hatched live on the roots of the grass. We are often not aware of the mischief they do in meadows and pastures. They remain as worms until toward the first of June under ordinary conditions. About that time they make the last transformation and become beetles, when they fly away to pastures and meadows to lay eggs again.

The larva lives from one to three years before making this transformation, depending on food conditions. Almost every creature has some means of protection with reference to the preservation of the species, and when food is very scarce it appears to hasten the process of pupation. It occurs to us, then, that the time to plow grass meadows and pastures would be as late in fall as weather conditions allow. Breaking up the burrows and the exposure to winter weather destroys vast numbers of them.

When such ground has been plowed for corn, work should begin just as early as possible in spring, and the soil kept thoroughly worked, and, as far as possible, any growth of green matter prevented. This should

continue until late planting time. The scarcity of food will perhaps hasten the transformation of the insect, while if we plant such ground very early we nearly always lose the stand from the ravages of the worms, and the second planting usually goes the same way. If we then try a third planting, in the latitude of central Missouri near June 1, it nearly always makes a superb stand.

When the insects have made their last transformation there will be no further damage. In the prairie country especially, the wire worm has been one of our most serious pests. From very wide observation it appears that the eggs are never deposited in clover, alfalfa, cowpeas or soy beans. I am not prepared to say, however, that this is absolutely true, but a number of years of careful watching makes this conclusion seem reasonable. If such be true, we can perhaps to a very great degree avoid damage by wire worms by a system of rotating crops whereby some of the legumes precede the corn crop the two years immediately before corn. By this plan we would reap a double reward by growing soil builders as well as preventing damage by wire worms.

THE CORN STALK BORER

This pest gives most trouble along badly kept fence rows or hollows, or where horse weeds are allowed to thrive. The horse weed is a particular favorite, and where they have been allowed to grow should be burned during the winter. The adult of this insect is a small moth that comes from the pupa. It lives in the pupa state in horse weeds and in corn stalks near the surface of the ground.

The work of this pest is noticed in spring when the corn is from 10 inches to 2 feet high. Some of the top blades, it will be noticed, are dead, and when these

are taken hold of a slight pull removes them. It will be found on examination that a pale, striped worm, sometimes three-fourths of an inch long, will be found in the heart of the stalk. This position has caused it sometimes to be called the heart worm. After a while it leaves this position, crawls down near the ground and bores into the stalk not far from the surface. In the fall it thus finds a refuge where it winds itself into a cocoon.

Its method of destruction in the corn is very easy. If the corn has been cut for fodder, however, the insect is not disturbed, as there is always a node or joint between where he is spending his time and where the stalk is cut, consequently he has dry quarters. Perhaps the most effective way of his destruction in the cornfield is to take a heavy harrow or drag of some sort and go over the field when the ground is frozen solidly, and the weather dry. This will smash off every stalk at the surface of the ground. This process kills vast numbers, and the stalks being shattered as well as the stump, the weather during the winter finishes the work.

THE CORN ROOT WORM

The little white grub shown in the illustration, Figs. 14 and 15, is the corn root worm. Its destructive work usually begins from the middle to the last of July, and is indicated by the stalks falling down without apparent cause. In some large areas the stalks will lie in every direction. A stalk thus affected can usually be pulled up very easily, as many of the roots are eaten off.

The eggs are laid about the plants, usually on the silk, and the larva drop to the ground and begin their work of destruction. In the northern part of the corn belt this pest is one of the very worst. It seems that

the larvæ live on corn roots only. This fact indicates that an easy method of destroying them is in rotation of crops. In a field where the corn root worm has given trouble one season corn should not be planted the next year. By changing from one field to another we can easily keep out of his reach. This pest is sometimes referred to as a "blessing in disguise" because he makes us rotate our crops whether we will or not.

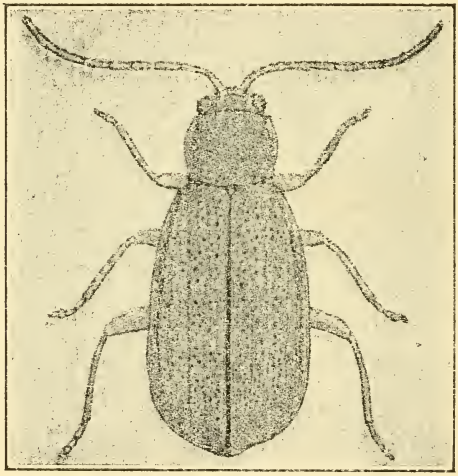


FIG. 14—WESTERN CORN ROOT WORM
Diabrotica longicornis, adult beetle; enlarged ten diameters.

THE COMMON WHITE GRUB

This pest, familiar to everyone, is the larva of the common May beetle. Its larval life sometimes extends over long periods, depending very largely on food and weather conditions. It lives, however, mostly on the roots of grasses and when the ground is plowed for corn sometimes a great deal of destruction results. If

hogs are given an opportunity they will root the ground in search of these worms, as they are very fond of them.

THE CUTWORM

There are several very closely allied species of this worm that are known by various names according to the habits of feeding and plants on which they live, Fig. 16. The common cutworm is familiar to perhaps everyone who ever worked in a garden or a field. It does not seem to be overly particular about what it eats, and it is known largely by its feeding method. It always works in the night and cuts the plant off at or near the surface of the ground.

FIG. 15—CORN ROOT AND LARVA

Corn root broken off to show larva of western corn root worm within; enlarged.

The cutworm is usually most troublesome in low, rich land and where grass lands have been plowed for corn. Its greatest destruction is in rather early spring. As the weather warms up it seems to burrow more deeply and pupation begins.

When there is likelihood of this pest giving trouble, the ground should be thoroughly worked in early spring, when plowing has been done in late fall or winter. It should be borne in mind that very late fall and winter plowing and very early working of the ground in spring are the most effective things that can be done in combating nearly all insect pests. We are safe in planting a little earlier where the cutworms

are likely to give trouble than we are in the case of wire worms.

Methods of poisoning are recommended, and this is entirely practical in gardens or in spots or fields where trouble is likely to occur. The poisoning of wire worms has met with little or no encouragement.

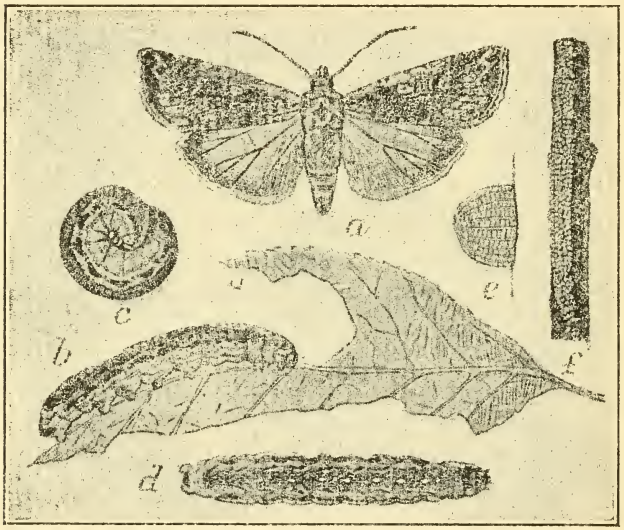


FIG. 16—THE VARIEGATED CUTWORM

Peridroma saucia; a, adult moth, natural size; *b,* normal larva, natural size; *c,* same in curved position; *d,* dark-colored larva, dorsal view; *e,* egg, greatly enlarged; *f,* egg mass on twig, natural size. (From Howard, U. S. Dept. Agri.)

One method of poisoning is to moisten wheat bran with sweetened water, preferably sweetened with sorghum molasses; with a bushel of bran thoroughly mix about one-fourth pound paris green. This poisoned bran is then placed in the evening in little piles over the ground where the insects will find it dur-

ing the night, and vast numbers of them are destroyed, as they seem to prefer it to the young corn. When these worms are poisoned usually none of them will be seen on the surface of the ground, as immediately after eating the bran they burrow into the ground, where they die. In the above method of poisoning, however, we are likely to poison birds, which we do not like to do. Another method of poisoning that is

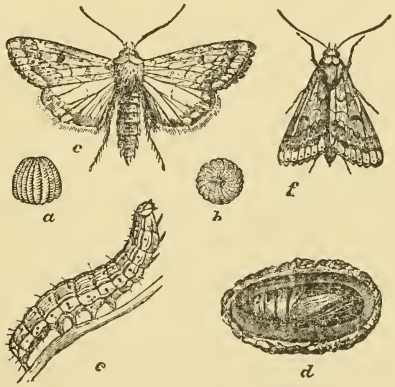


FIG. 17—CORN WORM

Heliothis armiger; a, b, eggs greatly enlarged; *e,* larva; *d,* pupa; *c, f,* adults.

entirely safe is to take young clover plants and soak them for a few hours in sweetened water in which paris green has been stirred. These sprigs of clover can be strewn over the ground in the evening and the worms will work on it in the night. About the only practical method, however, on large areas, is very late winter plowing, especially early and thorough work in the spring and planting late.

THE CORN EAR WORM

The corn ear worm, shown in the illustration, Fig. 17, together with some of the mischief it does, is familiar to everybody who grows corn. This is considered one of the worst of all pests and is perhaps the most difficult to combat. It is found, however, that the larvæ live in the ground during winter and that late plowing and early spring work is the most effective plan. Rotation of crops helps on this one because it is commonly known that late corn, or corn making a slow growth, is nearly always attacked worst by all enemies, especially this one.

It is often found that one field of corn will be almost free from attack where the ground is fertile and vigorous growth has been maintained, when just across the fence under the reverse conditions a worm can be found in almost every ear. It has been supposed by some that this worm dust in certain drouthy years when all insect pests are apparently worse has something to do with the destruction of live stock. It has been thought

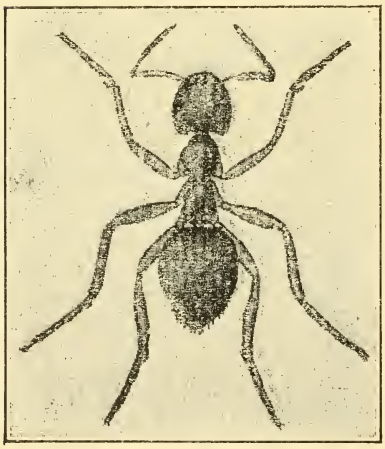


FIG. 18—WORKER ANT

Lasius niger alienus; enlarged eight and one-fourth diameters. This ant is always found where there are corn root lice. It is the one that burrows above the hills of young corn. Root lice can be found on the roots of the plants around which it burrows.

that the worm dust has some effect in producing a swine disease that seems to bear some resemblance to pneumonia. Where corn is very wormy it seems wise to shell it and thoroughly fan the dust out before feeding.

THE CORN ROOT LOUSE

This pest is much more common than is usually supposed. It is but very rarely it kills a corn plant, but merely dwarfs it and makes it unthrifty and often

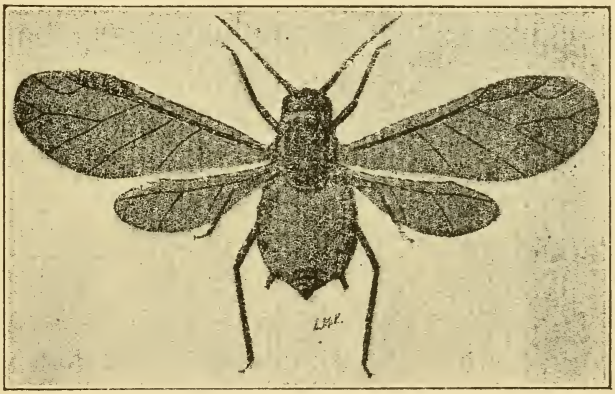


FIG. 19—CORN ROOT APHIS

Aphis maidiradicis, winged viviparous female; enlarged sixteen diameters.

prevents its producing an ear. The pest can usually be known to exist in every hill of corn where little ants are seen burrowing.

The illustrations, Figs. 18, 19 and 20, show the insect, also the ant that is always associated with it. This ant is sometimes called the "dairying" ant and the bug the "dairy cow" of the ant. It will be noted that there

are two little glands on the back portion of the insect. These little glands exude a sweetish fluid or a honey dew, as it is sometimes called, and the ant uses this for food. There are a great many varieties of plant louse and it will be noted that where they are found ants of some sort are always present.

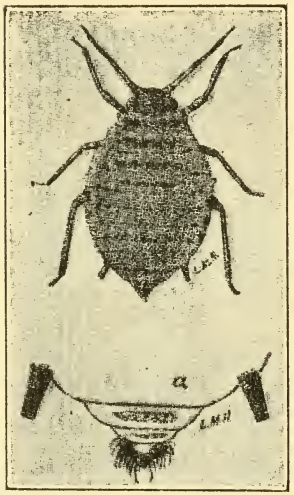


FIG. 20—CORN ROOT APHIS

Aphis maidiradicis, wingless viviparous female; greatly enlarged; *a*, apex of abdomen still more enlarged.

In autumn the ants gather the eggs of these insects and place them in their own burrows, caring for them until they hatch in the spring and caring for the young bugs until they are large enough to do their own feeding, when they carry them and place them on the roots of plants, preferably corn. If no corn can be found smartweed seems to be second choice. They will live, however, on practically anything that is green. This fact should be remembered, as we want to refer to it a little later.

When these bugs hatch in spring some have wings and some have not. All that hatch in spring are females. The winged ones go from the parent colony to other plants to start new colonies. During summer each one gives birth to living young, which are in turn all females. Thus each succeeding brood continues to produce living young during the summer months until late in fall, when young are produced of which some are male and some female.

These two sexes mate and eggs are laid for the next spring's brood.

When looking for the pest, note a hill of corn where the ants are burrowing and pull it out very carefully or lift it with a spade. Sometimes great numbers of bugs will be found in the crotches of the roots, some of them as large as pin heads and others almost too small to be seen with the naked eye. A careful examination will reveal that the ants have removed the dirt from a root or roots where the bugs are at work in order to facilitate the bugs' employment, and to make it convenient for the ants at "milking time."

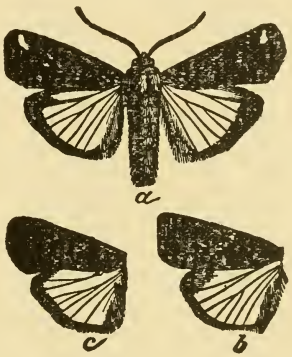


FIG. 21—THE FALL ARMY WORM

Laphygma frugiperda; a, adult moth, natural size; *b, c,* wings showing variations, natural size. (From Riley.)

The means of eradication we have at hand are freezing and starving. If we have planted our corn, however, and the pests are in it, all we can do that we know of is to cultivate thoroughly in order to give the corn the best opportunity to grow so fast that the work of the bugs is not so detrimental. When a field has been infested with these pests, fall and winter plowing, early spring work to keep down weed growth and medium late planting of corn is the most we can do. Crop rotation is somewhat effective—more, however, as a means of producing vigorous growth than of the destruction of the insects.

Two common enemies of the plant louse can al-

most always be found among the varieties of louse that feed above the ground. These are the ichneumon fly and the "ladybird." The ichneumon fly is not much larger than a gnat and somewhat resembles a small ant with wings. This little fly lays an egg in the skin of these lice and in a short time the eggs hatch a little worm. This burrows into the body of the louse, where it lives a short time, and when it gets ready to make the transformation into an adult fly it cuts a little hole in the back and upper portion of the louse that very much resembles a trap door. This process, of course, kills the louse and the fly makes its escape a perfect insect, when it is then ready to go in search of other insects in which to deposit its eggs. This little fly, incidentally, is perhaps our most effective helper in the destruction of the Hessian fly.

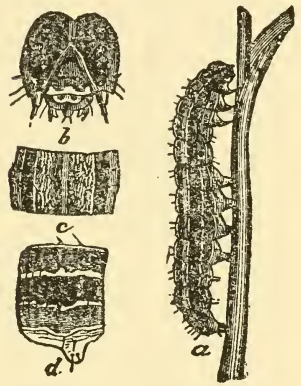


FIG. 22—THE FALL ARMY WORM

Laphygma frugiperdas; a, larva, natural size; *b*, its head, enlarged; *c*, *d*, its body segments, enlarged. (From Riley.)

The "ladybird" is a little oval-shaped bug, usually red with black spots. This is one of our very best friends, as it lives entirely on insects and insect eggs. The ladybird lays eggs from which are hatched little gray-colored larvæ or worms that have two sharp hooks on their heads. These insects can run very rapidly. They destroy plant lice by the thousands. The larva does not exceed a half inch in length, has light gray or

brown stripes running crosswise, and the body has a few hairs along the margin. The legs are all toward the front part of the body.

It sometimes will be noted that these colonies of plant lice are practically going to destroy everything, yet a little while later we find them nearly all destroyed, their dead bodies adhering to the leaves on which they had been feeding. The life history and habits of this insect are among the most interesting studies in all nature.

THE ARMY WORM

The true army worm has been named by the habit of living in large colonies and destroying everything green along its pathway. When they begin work in a field of corn perhaps not much better could be done than thoroughly rolling the ground two or three times in rather close succession with a roller weighted as heavily as possible. Where it is possible to do so if pigs can be turned in they will destroy them very rapidly. One of the most efficient sources of destruction is the common enemy of the army worm, a small fly somewhat resembling the common house fly. These flies deposit eggs on the bodies of the worms and the larvæ of the fly eventually destroy the worm.

THE FALL ARMY WORM

This is not a true army worm, but perhaps is allied more closely to the cutworm, Figs. 21 and 22. It appears in the fall on various new crops about the time grass begins to dry up. Their destruction is greatest on wheat, rye and other fall-sown crops following a dry year. If the season is moist, so that grass grows well during the entire summer, little fear need be felt

of the fall army worm doing mischief to fall-sown crops. Where they have begun trouble, however, heavy rolling is perhaps one of the most effective means of destroying them. A plan that has sometimes been recommended where there is a grove near and plenty of blackbirds in it, is to sow a little white corn on the surface of the ground in the region where the worms are giving trouble. The birds easily find the corn and while at work at that discover the worms. As the birds are very fond of the worms they soon work their destruction.

THE CHINCH BUG

This is one of our very serious pests, especially in parts of the country where wheat is grown extensively. The chinch bug continues to multiply very rapidly until an excessively wet year occurs, when most of them meet destruction, apparently by disease. They usually attack the corn as soon as small grains ripen and harvesting is done. They do their damage by sucking the juices from the plants. An effective means of preventing their entering the corn field from a wheat field is to plow a few furrows between the fields, and by back furrowing and using a rolling cutter set just a little to the outside of the shin a smooth wall is made, and with a post augur holes are made at intervals into which the bugs fall. They cannot climb these perpendicular walls, hence perish.

Where weather conditions will not admit of this treatment a smooth strip of ground is arranged and an evenly tarred string, such as binder twine, is placed along the ground. It is found that the bugs will not cross it. Another effective means of combating chinch bugs is very evident when we learn its habits of living over winter. They crawl under rails, boards or sticks

and gather around the roots of clumps of grass or anywhere they may find shelter. They also collect in vast numbers between the stalk of corn and the sheath of the plant that surrounds it. When corn stalks are thus infested they should be burned in winter. In regions where chinch bugs give trouble all clumps of grass should be burned, the fire being set on a still, dry day in order that it will burn as deeply into the roots as possible. Cleaning up all trash and rubbish is also very helpful.

THE GRASSHOPPER

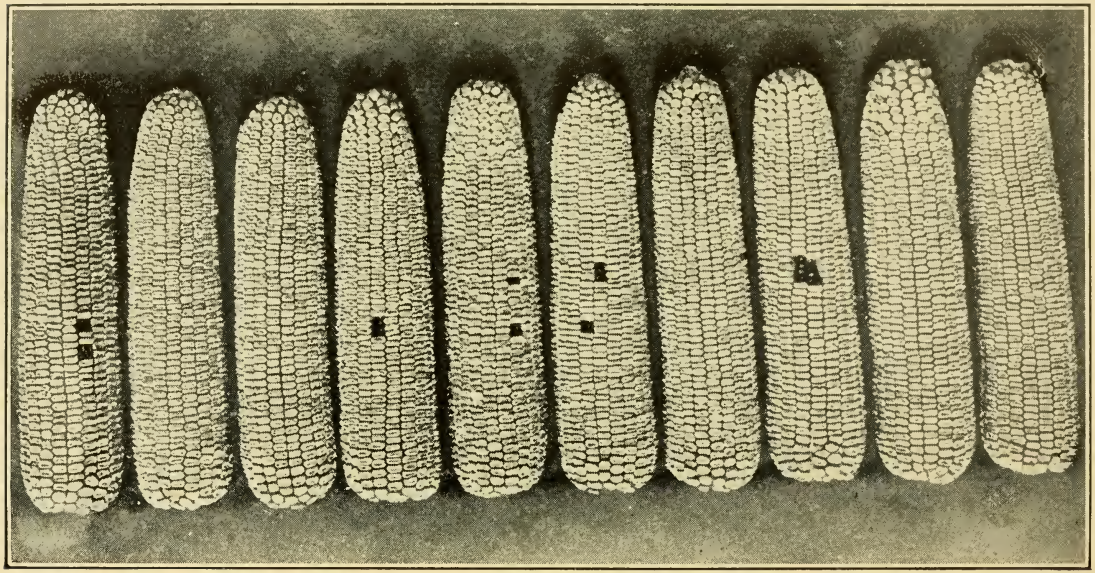
It is hardly necessary to take space to describe the grasshopper, as almost every boy knows that this pest has two teeth set in very heavy jaws and that he is a great feeder; that during the noontime when we have left the pitchfork leaning against a shock of hay he likes to get upon the handle and gnaw it, no doubt because of the salt left upon it from the perspiration of our hands. The grasshopper's appetite and his boldness about it has led, to a very great degree, to his undoing.

One of the older methods of destroying grasshoppers was by an apparatus known as the "hopper dozer." This is made something like a long trough with a shield at the back. A horse is hitched at each end, and it is dragged across the field, after kerosene has been put in the bottom of the trough. The hoppers fly against the screen and fall into the oil; only a small particle of oil touching him means death.

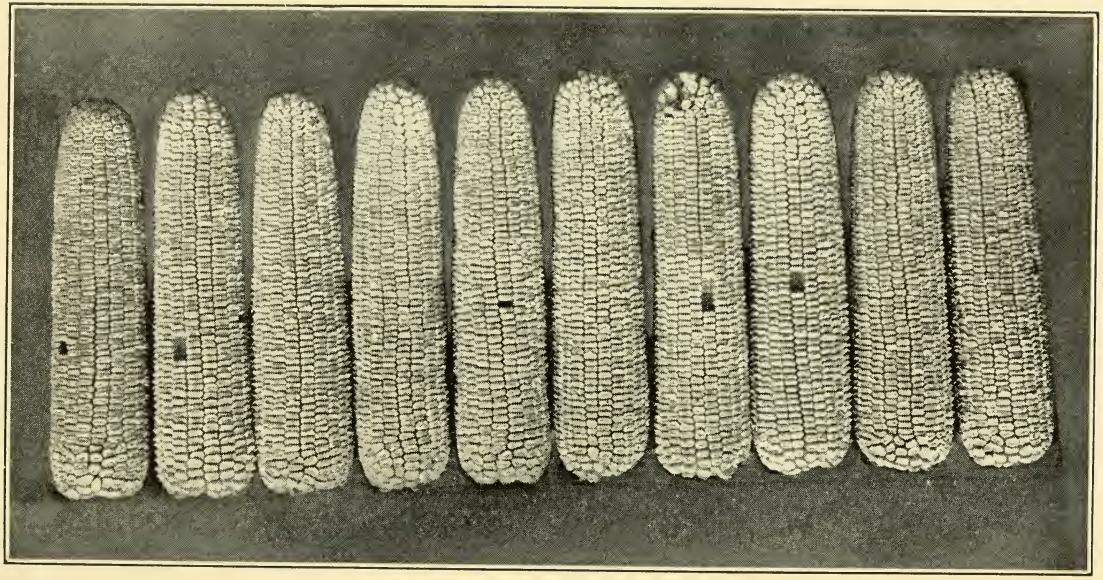
It has been found, however, that a better and more certain way is to poison them with poisoned bran, using in addition to the formula given for cutworms a little salt. The grasshopper is very fond of salt and the sorghum may well be omitted from the bran, but the

salt should always accompany it. It is very doubtful whether birds that destroy grasshoppers would be injured by eating those that had been poisoned, as it is doubtful if enough is consumed by the bird to kill it.

There is one of the species known as the Rocky Mountain locust concerning which people who can remember back as far as the early seventies can recall scenes they hope will never be repeated. Those of us who remember what is known as the grasshopper year can remember seeing the air almost as full of hoppers as they were rising as we have ever seen it filled with snowflakes. We have seen entire fields completely stripped of every green thing upon them. These grasshopper years in some states have been prevalent to such a degree that had they been general over the country a destructive famine would have followed.



Some Good Boone County White—Winner of Boys' Sweepstakes



TEN GOOD EARS OF JOHNSON COUNTY WHITE

CHAPTER XVII

Selecting Corn for Show

A discussion of corn for showing seems important here, since almost every community in the corn belt is giving attention to growing fancy corn. In selecting a sample for the show the rules largely govern as in selecting anything else for exhibition. Trueness to type, quality, conformation and uniformity in all points are the chief features. In selecting the 10 ears we should use every effort to have the ears as nearly alike in every possible particular as we can find them. This is no easy thing to do, as can be verified by anyone who has selected show corn for a few years. It sometimes appears that entire fields are searched, and yet we are unable to find 10 ears that can win a good prize.

Each ear should conform to the standard for that variety, and it will be found many times that the ear having the finest conformation and that is truest to type will be a little too large or a little too small to match the others. In selecting a driving team we would certainly not select a team varying in size, form, nor action. If to pull a big load was the only object, we might get a good pulling team by securing a large mule and a good-sized horse. For feeding purposes it matters little as to whether or not an ear is fancy, but in the show ring we keep foremost in mind the idea of reproduction. This being true, the larger ear is not necessarily the best ear at all. The ear that contains the grains that, when planted, will produce a greater amount of good corn than others is the objective point of the seed corn grower.

A sample of show ears should be of equal length,

equal circumference, equal number of rows, uniform indentation, and free from indications of mixture. A good deal of practice will be found necessary before any person can become a winner in some of the great corn shows of the country. Every state corn growers' association, or its university, has a score card giving most nearly the requirements of that particular locality. These cards can usually be secured without cost by addressing the college of agriculture and on each card will be found full instructions as to how the points should be graded.

CHAPTER XVIII

Corn Contests

Corn contests have been instituted in every state of the corn belt, and some remarkable results secured. The greatest number of bushels to the acre is not the only point to be gained, because when a boy once gets into the work of growing fancy corn it usually means that his life will be spent upon the farm. It is one of the easiest of all ways by which we can begin to teach him to apply his brain in farm work. It is perhaps true that on an average the boys between the ages of 14 and 20 years are better judges of show corn than are men 60 years old. This is because the older ones were not given the training the younger ones have received. It can always be noted at any show or fair that an exhibition of corn is most attractive and the judging contests and the acre-yield contests are productive of great interest. Every county, at least in the corn belt, should have an organization and use every possible means to interest our young people in the production of crops of greater quantity and better quality.

CHAPTER XIX

Fertilizers for Corn

It is commonly known that barnyard manure is one of the best of all fertilizers, yet the fact remains that there is practically no farm on which a sufficient amount of barnyard manure is produced to supply the demands of the various crops. For corn as well as some of the other grains excessive manure is not entirely satisfactory because manure may be termed an "unbalanced" fertilizer. This is noticeable where feed lots are broken up for planting corn, or sowing to small grains. We always find in such places a good supply of humus, as well as a good supply of nitrogen; but it often occurs that this feed lot soil is deficient in both phosphorus and potash. This is evident from the fact that usually an enormous amount of stalk growth occurs, which indicates plenty of nitrogen. We often find that the grain is not in proportion to the plant growth. This indicates a shortage of phosphorus. We find also in such cases that the grains are likely to stalk-fall badly, showing a lack of potash in the soil. Even a feed lot, therefore, can sometimes be benefited by the addition of phosphorus and potash.

The worn soils are almost always deficient in nitrogen; most of them deficient in phosphorus and a great many deficient in potash. Every farmer should be able to determine from the behavior of his crops about what fertilizers are needed; usually a complete fertilizer of some sort is used, but where cowpeas or soy beans or clover has been growing on the land a few previous years we need be at no further expense to buy nitrogen as a commercial fertilizer. Under those cir-

cumstances, however, we would need to supply phosphorus and potash as a commercial fertilizer.

The methods of applying fertilizers vary according to the composition of the soil. Fertilizers may be put more deeply in a soil of tight or fine texture than in a sandy or more porous soil. The tendency in porous soil is too much toward leaching.

If manure is applied, perhaps one of the best ways is to plow it under, when the plowing can be done in the fall. This is also true in the tight soils where it is desired to grow corn, as it induces the roots to grow more deeply than if the manures were applied closer to the surface. It is not a very safe practice, however, to plow heavy coatings of vegetable matter under in the spring or at such time as they will not be well rotted during the earlier part of the growing season. Undecayed vegetable matter interferes with the capillary action of water in the soil, and crops are likely to suffer during the dry weather.

Where commercial fertilizer is used it is put in with the fertilizer attachment on the planter as often as any other way. This commonly gives very good results unless the season be very dry, causing corn to burn out because of the shallow root system induced by the fertilizer being too near the surface. It, no doubt, gives better results when the fertilizer is placed an inch, 1½ inches or 2 inches deeper than the corn is planted. There is some objection to using fertilizer on all the field, as it induces weed growth between the rows, and some of it is thus lost, making cropping operations more expensive.

We are always safe to use commercial fertilizers as long as we do not lose sight of the fact that we must at all hazards keep up the humus content of the soil. In applying commercial fertilizer every farmer should

attempt to understand as well as possible what his soil needs and buy such brands as will most nearly meet that demand. It too often happens that we apply a certain element in fertilizer that our ground perhaps does not need. In such an event money and time are wasted.

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